AUTOMOTIVE INDUSTRIES

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## This Week

If you will turn to page 380 you will find described a new high-speed Diesel of Citroen design.

The automotive industry is more or less in the throes of labor unrest and the history of the sitdown movement on page 381 is of particular interest at this time

At the Cadillac plant there is a unique plant set-up that unifies the manufacturing operations of three lines of cars each with its own peculiar requirements. Joseph Geschelin tells the whole interesting story in this month's production feature. Turn to page 388.

# Spring Demand Boosts Output

### *With General Motors Again at Capacity, March Production Is Expected to Approach 600,000*

By Harold E. Gronseth

First signs of the spring upturn in automobile sales are discernible in the retail delivery figures being reported to factories by dealers. While it is a little early to expect any appreciable rise in the final reporting period of February, nevertheless some good gains were recorded over the corresponding period of the preceding month and advance indications on the March rate of sales are sufficient to denote that the spring advance is under way.

Meanwhile the factories are busy pushing production up to a new post-depression high. With steadily gaining momentum, output has climbed to a daily rate of approximately 25,000 units, five days a week. On this basis the 23 working days in March will account for 575,000 vehicles. But the top in daily production has not been reached as yet. General Motors, speeding along to make up lost time, is skirting its previous record for daily production. Some divisions are back to their former peaks on current models but others have farther to go. Chrysler is operating up to the hilt. Ford daily output is at a new high on 1937 models. Most of the independent producers are expected to go higher before the month is out.

The "Big Three" alone will cross the half-million mark in March and at their current rate of output will turn out more vehicles than were built by the entire industry in its peak month last year, which was April with a total of 527,726 cars and trucks.

Barring interruptions by labor troubles or material shortages, a 600,000-unit month is not an improbability for March. The month is very likely to

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# Chrysler-UAW Talks "Amicable"

### *Seniority and Exclusive Bargaining Privilege Expected to Prove Controversial Points*

The conference between representatives of the Chrysler Corp. and the United Automobile Workers Union, in which the principal issue is the union's demand for exclusive bargaining rights, got under way Wednesday morning. The first session was taken up for the most part with reading of the eight union demands, establishment of ground rules and procedure. Discussion was started on the subject of seniority which the union outlined in great detail in its formal list of demands. The rules suggested are different from those now in existence.

Sessions will be held from 10 to 12 o'clock in the morning and from 2 to 4 in the afternoon. The bargaining committee for the union consists of Homer Martin, president; John Brophy, CIO director; Richard Frankensteen, UAW director of organization; R. J. Thomas, president of the Chrysler local; George Wilson, president of the Dodge local, and O. E. Zimmerman, president of the Dodge Truck, Forge and Amplex local. In all, the union has 18 men at the conference, three from each of the six Chrysler locals. Those not on the bargaining committee occupy a room adjoining the conference room and will remain available for consultation. The corporation had only two representatives in the first day's sessions of the conference, Herman L. Weckler, De Soto vice-president and L. L. Colbert, attorney for the corporation, but will substitute or increase the number of its representatives as it sees fit.

The plan is to dispose of points not needing much discussion as promptly as possible and then tackle the more controversial subjects such as seniority and exclusive bargaining privilege. Being an involved subject, which the union has treated with great detail in its demands, the matter of seniority was expected to take up considerable time.

Resignations of all union men on the Chrysler employe representation board set up under the old Labor Board rules were presented at the afternoon session of the first day's conference. Union men represented a substantial majority of the members of the board

(*Turn to page 386, please*)

# Parts Strikes Spread

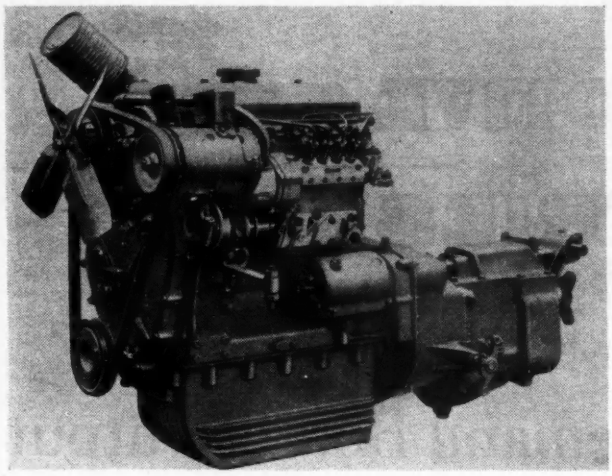
### *Detroit Area Center of Widening Sitdown Movement*

More automobile accessory plants became involved during the past week in the wave of sitdown strikes spreading over the Detroit industrial district, and which lately has extended into the mercantile field to include two of the Woolworth 5 and 10-cent stores.

Sitdown strikes spread Tuesday to three key plants in the automobile industry. They are Motor Products, Zenith Carburetor, and Murray Body.

Demands at all three plants include these points: Recognition of the UAW

(*Turn to page 387, please*)



Citroen four-cylinder high-speed Diesel for light trucks

# Citroen Builds High-Speed Diesel

***Four Cylinder Engine for Light Trucks Has 107 cu. in. Displacement and Maximum Speed of 3500 r.p.m.***

A four-cylinder high-speed Diesel of only 107 cu. in. piston displacement has just been put into production by the André Citroen Co. of Paris, after experiments extending over a couple of years. This engine is being made use of on light trucks with a load capacity of respectively 1000, 1800 and 3300 lb. Despite persistent reports to the contrary, Citroen officials maintain that there is no intention, for the present at any rate, of adapting it to passenger cars. Nevertheless, two taxicabs have been in service on the streets of Paris with this engine for a certain time.

Having a maximum speed of 3500 r.p.m., and an output of 40 hp., the Citroen Diesel will throttle down to 350 r.p.m. and, it is claimed, is entirely free from smoke and smell throughout the entire range of speed.

The cylinders are one casting with dry liners. A detachable head built under Ricardo license, is used and is of special alloy, the nature of which is not revealed, but not embodying aluminum. Valves are in the head, with pushrod and rocker operation and are seated directly in the head. The unusually high compression ratio of 20 to 1 is employed, with aluminum alloy pistons having two compression and three scraper rings.

Injection is by means of a Bosch-Lavellette pump, with an injector nozzle having the unusual diameter of 2 millimeters, and an injection pressure of 1420 lb. per sq. in. While this removes any possibility of the nozzle choking, it is claimed that complete pulverization is assured by the turbulence head.

The crankshaft is carried in three bearings, rods are I section, and high pressure lubrication is used with a big capacity ribbed aluminum base chamber. There is belt drive for the 12-volt electric generator and the combined water pump and fan. Heating plugs are used to facilitate starting, while the electric starting motor is a separate unit.

The engine unit, single plate clutch and four speed gearbox with synchromesh third, has floating attachment to the frame. Normal lines are followed in the chassis, which does not embody the torsion bar independent suspension used on Citroen passenger cars. Instead, springs are semi-elliptic front and rear, the forward pair having the shackles in front. The rear axle is semi-floating type on Timken roller bearings, with spiral bevel gear. The drive shaft is open and brakes are Bendix.

Weight of the motor without flywheel is 444 lb. Dimensions are: length 35 in., width 18.5 in., and total height 27.5 in.

## Boeing Begins Production of 4-Engined Transport Planes

Arrival of the long-predicted "four-engine era" in aviation appeared at hand when it was revealed that the Boeing Aircraft Co. is immediately beginning production of giant four-engined bombers and "clipper ships." The Boeing company announces that it is now devoting its huge Seattle factory exclusively to the production of four-engined aircraft.

First indication that Boeing would introduce four-engined passenger transports was the announcement last week by Transcontinental and Western Air, Inc., that it has contracted for a fleet of such planes.

The fleets of four-engined Boeings now under construction will be so designed that sub-stratosphere flying will be possible through the addition of pressure equipment for supercharging the passenger cabins, it was revealed. Two of the new planes, in particular, will be provided immediately with all the necessary equipment for sub-stratosphere flight. In general design, the Boeings will be all-metal low-wing monoplanes, with full cantilever wings and tail surfaces, retractable landing gear and tail wheel, and air-operated wheel brakes. Their cabins will provide

## Passenger Car Production by Wholesale Price Classes

*(U. S. and Canada)*

January, 1937, compared with January, 1936

| | 1937 | 1936 | Per Cent Change | Per Cent of Total 1937 | Per Cent of Total 1936 |
|---|---|---|---|---|---|
| $500 and under | 147,868 | 179,042 | −17.4 | 45.55 | 57.84 |
| $501-$750 | 161,942 | 115,275 | +40.3 | 49.89 | 37.24 |
| $751-$1000 | 11,028 | 10,864 | + 1.5 | 3.40 | 3.51 |
| $1001-$1500 | 2,232 | 3,096 | −27.9 | .69 | 1.00 |
| $1501-$2000 | 1,188 | 685 | +73.3 | .36 | .22 |
| $2001-$3000 | 315 | 526 | −40.1 | .10 | .17 |
| $3001 and over | 30 | 47 | −36.1 | .01 | .02 |
| Total | 324,603 | 309,535 | + 5.0 | 100.00 | 100.00 |

## Truck Production by Capacities

*(U. S. and Canada)*

| | 1937 | 1936 | Per Cent Change | Per Cent of Total 1937 | Per Cent of Total 1936 |
|---|---|---|---|---|---|
| 1½ Tons and less | 70,840 | 64,298 | +10.1 | 94.67 | 94.88 |
| 2 to 3 Tons | 2,586 | 2,409 | + 7.4 | 3.46 | 3.55 |
| 3½ Tons and over | 920 | 609 | +51.0 | 1.23 | .90 |
| Special, buses and station wagons | 477 | 455 | + 4.9 | .64 | .67 |
| Total | 74,823 | 67,771 | +10.4 | 100.00 | 100.00 |

# Passenger Car and Truck Production — U. S. and Canada

| | January, 1937 | December, 1936 | January, 1936 |
|---|---|---|---|
| Passenger Cars—U. S. and Canada: | | | |
| Domestic Market—U. S. | 285,892 | 398,581 | 280,968 |
| Foreign Market—U. S. | 23,702 | 27,438 | 17,306 |
| Canada | 15,009 | 16,542 | 11,261 |
| Total | 324,603 | 442,561 | 309,535 |
| Trucks—U. S. and Canada: | | | |
| Domestic Market—U. S. | 54,017 | 60,062 | 54,633 |
| Foreign Market—U. S. | 16,232 | 12,640 | 11,097 |
| Canada | 4,574 | 3,869 | 2,041 |
| Total | 74,823 | 76,571 | 67,771 |
| Total—Domestic Market—U. S. | 339,909 | 458,643 | 335,601 |
| Total—Foreign Market—U. S. | 39,934 | 40,078 | 28,403 |
| Total—Canada | 19,583 | 20,411 | 13,302 |
| Total—Cars and Trucks—U. S. and Canada | 399,426 | 519,132 | 377,306 |

accommodations for 32 passengers in daytime flight and for 26 on overnight trips, with berths for 18 and reclining chairs for eight more.

Four Wright Cyclone engines will give the plane a cruising speed of more than 200 m.p.h. and a possible speed at high altitudes in the neighborhood of 250 m.p.h. The airliner will have a wing span of approximately 107 ft. In addition to its passenger load, it will have room for 3750 lb. of cargo—more than the total payload of transport planes now in service.

## December Tire Shipments 23% Above Previous Year

Shipments of pneumatic casings during the month of December are estimated at 5,015,872 units, an increase of 18.5 per cent over November and 22.9 per cent above shipments made in December, 1935, according to statistics released by the Rubber Manufacturers Association, Inc.

This organization estimates production of pneumatic casings for December at 5,311,007 casings, an increase of 6.8 per cent above November and 31.1 per cent above December, 1935.

Pneumatic casings in the hands of manufacturers, Dec. 31, 1936, are estimated at 11,114,399 units, an increase of 2.7 per cent over the stocks on hand Nov. 30, and 35.6 per cent above stocks on hand Dec. 31, 1935.

# How Sitdown Strikes Began

### *Often Called an Importation from France, the First Modern-Style Sitdowns Were in Akron*

Who invented the sitdown strike?

The popular belief, often stated in the press, is that the sitdown strike in its modern technique is a foreign importation; that the first real sitdowns were staged in France in May, 1936, just before Premier Blum's socialist government came into power. But the facts are that the sitdown strike, as now employed in all sorts of industries and in all parts of the country, is an American discovery. And of even greater interest is the fact that it was at first condemned by labor leaders.

The first modern sitdown strike—probably the first of its sort in the world—was an accident, rather than an invention. On Jan. 29, 1936, a tire builder employed by the Firestone Tire & Rubber Co. in Akron, and a member of the United Rubber Workers of America, got into an altercation in the plant with a non-union worker. The union employe was dismissed, and immediately 800 fellow unionists decided to protest, called a strike and walked out of the plant.

The action had so far followed the conventional pattern of minor industrial disputes. But it was late afternoon when the men started to walk out of the factory, the temperature was near zero and a bitter north wind was blowing. They decided it would be more comfortable waiting inside the plant, so they went back to their machines, sat down, and did nothing. When quitting time came it still seemed far more comfortable to be sitting inside than walking a picket line, so they decided to stay through the night shift. Incoming night workers joined them, so that on the following day almost twice the normal number of workers were sitting around and production in the affected plant been stopped. The sitdown lasted for three days and was settled by arbitration between the management and union officials.

The first effective sitdown may thus be described as accidental, resulting from weather hazards. But news of the new technique spread, and at about

(*Turn to page 407, please*)

# Delivered Prices Fixed

### *Additional Passenger Car Makers Announce New Lists*

Delivered prices, f.o.b. factories, including the usual accessories, delivery charges and the Federal tax have been announced by Cadillac, La Salle, Oldsmobile, Cord, Chevrolet, Hudson and Terraplane.

The new lists are as follows:

## CADILLAC

| | At Factory Del'd | F.O.B. | Differ'l Per Cent |
|---|---|---|---|
| **V 8 Series 60** | | | |
| Sport coupe, 2-p. | $1,555 | $1,445 | +7.6 |
| Tour. sedan, 4-d., 5-p. | 1,660 | 1,545 | +7.5 |
| Conv. coupe, 2-d., 2-p. | 1,690 | 1,575 | +7.3 |
| Conv. sedan, 4-d., 5-p. | 2,020 | 1,885 | +7.2 |
| **V 8 Series 65** | | | |
| Tour. sedan, 4-d., 5-p. | 2,090 | 1,945 | +7.3 |
| Sport coupe, 2-d., 2-p. | 2,805 | 2,645 | +6.0 |
| Tour. sedan, 4-d., 5-p. | 2,595 | 2,445 | +6.0 |
| Conv. coupe, 2-d., 2-p. | 2,905 | 2,745 | +5.8 |
| Conv. sedan, 4-d., 5-p. | 2,960 | 2,795 | +6.0 |
| **V 8 Series 75** | | | |
| Tour. sedan, 5-p. | 2,815 | 2,645 | +6.3 |
| Formal sed., 5-p. | 3,685 | 3,495 | +5.5 |
| Town sedan, 5-p. | 3,325 | 3,145 | +5.7 |
| Conv. sedan, 5-p. | 3,630 | 3,445 | +5.2 |
| Tour. sedan, 7-p. | 2,970 | 2,795 | +6.2 |
| Imp. tr. sedan, 7-p. | 3,170 | 2,995 | +6.0 |
| Sp. tr. sedan, 7-p. | 2,610 | ... | ... |
| Sp. I. T. sed., 7-p. | 2,810 | ... | ... |
| Bus. tr. sed., 8-p. | 2,745 | ... | ... |
| Bus. I. T. sed., 8-p. | 2,950 | ... | ... |
| Town car, 7-p. | 4,755 | 4,545 | +4.3 |
| **V 12 Series 85** | | | |
| Tour. sedan, 4-d., 5-p. | 3,535 | 3,345 | +5.6 |
| Tour. sedan, 4-d., 7-p. | 3,690 | 3,495 | +5.6 |
| Im. tr. sed., 4-d., 7-p. | 3,890 | 3,695 | +5.3 |
| Town sedan, 4-d., 5-p. | 4,045 | 3,845 | +5.0 |
| Formal sed., 4-d., 5-p. | 4,400 | 4,195 | +5.0 |
| Conv. sed., 4-d., 5-p. | 4,350 | 4,145 | +5.0 |
| Town car, 4-d., 7-p. | 5,475 | 5,245 | +4.5 |
| **V 16 Series 90** | | | |
| Coupe | 7,645 | ... | ... |
| A. D. coupe | 7,800 | ... | ... |
| Conv. sedan | 8,105 | ... | ... |
| Town sedan | 7,495 | ... | ... |
| Sedan, 7-p. | 7,595 | 7,350 | +3.2 |
| Limousine, 7-p. | 7,800 | 7,550 | +3.4 |
| Imp. cabriolet | 8,055 | ... | ... |
| Town cabriolet 5-p. | 9,025 | ... | ... |
| Town cabriolet 7-p. | 9,130 | ... | ... |
| Sedan, 5-p. | 7,545 | ... | ... |
| Lim. brougham, 7-p. | 9,025 | ... | ... |
| Imp. cabriolet, 7-p. | 8,105 | ... | ... |
| Coupe, 5-p. | 8,105 | ... | ... |

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**The "Arrowbile," invented by Waldo Waterman, has been flown successfully at Santa Monica, Calif. Powered by a six-cylinder Studebaker engine, the plane reaches a speed of 125 m.p.h. in the air and, with the wings detached, it runs as an automobile at 55 m.p.h.**

Acme photo

# Lincoln Arc Welding Contest Rules

## *446 Prizes Totaling $200,000 Will Be Awarded for Papers on Arc Welding in All Branches of Industry*

The general rules and conditions of the $200,000 arc welding prize contest sponsored by the James F. Lincoln Arc Welding Foundation have been announced. The purpose of the foundation, it is stated, is "to encourage and stimulate scientific interest in, and scientific study of the development of the arc welding industry through advance in the knowledge of design and practical application of the arc welding process, and to provide for the payment by awards, by prizes, to those persons who by reason of the excellence of their papers upon said subject may be selected in the manner herein provided as most worthy to receive such awards."

The contest embraces practically every field of industry where arc welding can be applied. For the purposes of the contest, industry has been broken down into 11 main classifications and 44 sub-classifications, in each of which prizes are offered in addition to the main prizes.

The automotive industry receives classification "A," subdivided into: A-1, engines; A-2, bodies; A-3, frames; and A-4, trailers. The aircraft industry, classification "B," is subdivided into: B-1, engines; and B-2, fuselages. Other industries using arc welding are given subsequent classifications and subdivisions.

A total of 446 prizes are provided for papers in the contest. From the 44 subclassifications, 220 papers will be selected to receive prizes totaling $81,400. From these papers 44 will be selected to receive prizes totaling $74,800 in the main classifications. From the 44 main classification prize papers, four will be selected to receive the main contest prizes totaling $26,000.

There will also be 178 prizes of $100 each for papers which do not share in any other award but which, in the opinion of the jury of award, deserve honorable mention. These may be selected from any classification.

The winner of the grand prize will receive $13,700. He will receive the first prize of $10,000, the first prize of $3000 in his main classification and the first prize of $700 for his subclassification.

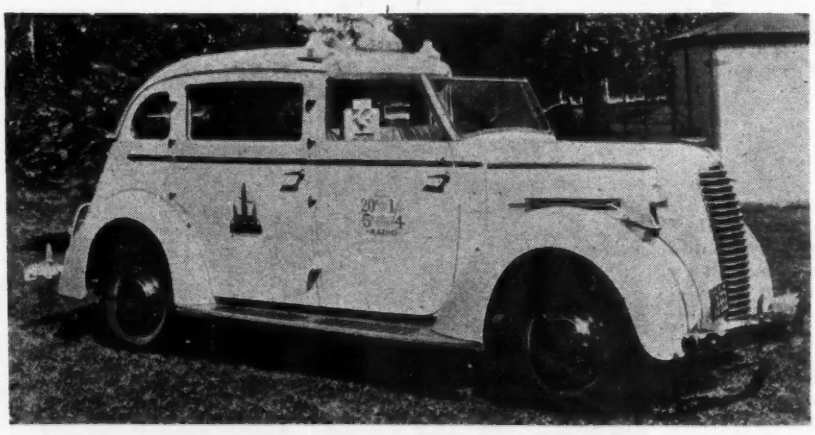
The contest may be entered by any person or group. To be eligible, each contestant must actually have participated in work upon which the subject matter of the paper is based, and his relation to the work must be clearly stated. Only papers contained in envelopes postmarked not later than June 1, 1938, will be accepted.

The jury of award will be drawn from members of the Department of Electrical Engineering of the Ohio State University and others selected by the chairman of the jury of award, E. E. Dreese, of the University of Ohio. Communications relative to the contest may be addressed to the secretary of the James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio.

## New Bantam in Production Within 60 Days, Says Evans

Production of the new American Bantam automobile will start within 60 days, R. S. Evans, president, stated this week. The company has started negotiations for materials and is preparing the plant for the manufacture of the new model. Evans states that inquiries for the new car indicate maximum production for the balance of 1937.

Quarter-ton trucks, in panel and pick-up body styles, will be featured by the company. A line of passenger cars will include a business coupe, standard and deluxe coupes, roadster and custom-built speedster.



**One of the new "Town Cab" taxis, built by the Moller Manufacturing Co. of Hagerstown, Md., now in service in New York City. The custom-built, stream-lined body is mounted on a Diamond T ¾-ton chassis. A new upholstery material, "Nucraft," produced by the B. F. Goodrich Co. and consisting of hair cloth insulated with Latex fabricated into loops forming a structure of figure eight springs, has been used in the cabs**

## Firestone Plant Picketed, 10,000 Employes Affected

The entire Firestone plant closed Thursday, March 4, and was being picketed by members of the rubber-workers' union. Employes of Plant No. 1 walked out in protest against the closing of Plant No. 2 by the company as a result of a small sitdown of tire builders. Ten thousand workers are affected by the strike. Only office employes are being admitted to the plants.

# Dealers Meet in N. Y.

## *Buckman Warns Against Labor's Threat to Organize Shop Workers*

Automobile dealer labor and legislative problems were the keynote of the mid-winter meeting of Automotive Trade Association Managers held in New York, March 1-3.

Speaking for the association Herbert Buckman, president, pointed out that already labor has started to organize the retail end of the automobile industry and that unless the parade is stopped by aggressive effort on the part of state and local dealer associations it is only a question of time until the organization is complete.

Believing that automobile manufacturers can lend strong support to reducing vulnerability in local fields, the association adopted a resolution calling for the indirect cooperation of the car makers in reducing the cost of collection of funds absolutely necessary for the work, and in making information on preferable procedure more widely available for both.

While it was the opinion of those present at the meeting that in several states, organizations of dealers are well equipped to deal with legislative and labor problems, it was felt that legislative work is hampered in some states because so large a proportion of needed funds is absorbed in cost of collection and that, in improving that condition, automobile manufacturers could, without making direct contributions, be helpful and effective.

Another highlight in the meeting was the address of Hon. G. Erle Ingram, Wisconsin state senator and advocate of the licensing of finance companies, automobile dealers and salesmen. Senator Ingram stressed the fact that the strength of the Wisconsin licensing law lay entirely in the ability of the state's banking commission to enforce it, and he advised other state dealer associations who are considering similar mea-

sures to look first to that phase of the legislation before going ahead with their plans.

Other speakers on the three day program included: Gordon L. Hostetter, executive director of the Employers' Assn. of Chicago; Don Blanchard, secretary of the Engineering Relations Committee of the SAE; John J. Hall, National Bureau of Casualty and Surety Underwriters; Arnon Benson, general manager of NADA; Alfred Reeves, vice-president and general manager of the AMA, and John E. Raine, general manager, Automobile Trade Assn. of Maryland.

# Modified NRA Proposed

## *Administration Sends Congress Committee Report Recommending New Industrial Standards Law*

By L. W. Moffett

Definite Administration plans for wage, hour and trade practice legislation at the present session of Congress were laid before Congress by President Roosevelt last Tuesday in a message transmitting a 240-page report on the defunct NRA by the Committee on Industrial Analysis. The President has said that he hopes for such legislation and it is expected that it will be introduced in Congress within a month or so. Reflecting a sharply modified NRA, it is the general opinion that the President will not ask for the legislation until after Congress has acted upon his Federal judiciary organization plan. The outcome of the plan, now the object of bitter attack and equally as bitter defense, probably will determine essential points in the proposed industrial regulation legislation. In any event it will be submitted in separate measures and so drafted as to hurdle the more obvious constitutional obstacles which brought about the downfall of the old NRA by a unanimous Supreme Court decision.

The committee report, which the President's message said "should furnish invaluable aid to Congress in the consideration and determination of vital legislative problems," was quite critical of some of the aspects of NRA, and while neither the report nor the President's message made any recommendations, the committee comments were sufficiently definite to guard against some constitutional pitfalls in framing new legislation.

An outstanding statement of the committee report which undoubtedly will be reflected in forthcoming legislation is that NRA attempted too much. It strongly hinted that only the larger and more basic industries—which obviously would include automotive, steel, textile, etc.—should be brought under the legislation which would possibly be expanded later to include a wider range of industries. It is expected care will be taken to encompass only industries and businesses of an undoubted interstate character.

Labor will come in for its part in a measure which will provide for minimum wage, maximum hours and the right of collective bargaining. It is suspected that a 40-hour week probably will be the chief yardstick.

As to hours, the committee said that whenever more goods would be worth more to the worker than more leisure, hours should not be shortened. The necessity of shortening them below this standard, it was pointed out, is a confession of failure in the system. Standards for a permanent policy, said the committee, should be formulated in the light of candid examination of possibilities of limiting production instead of merely spreading work.

The board stated that it also seems if any relaxation of the anti-trust laws is contemplated to permit trade agreements intended to coordinate the practice of competing business within the field that has been referred to as "stabilization," the decision to make such relaxation should be by legislative action. This obvious thrust at executive fiats intended to carry the force of non-existent law, proceeds to add that any administrative body empowered to review and to approve such trade agreements should be expressly authorized by Congress to approve agreements within that field.

"Finally," the report concludes, "while labor and trade practice aspects of an industry program are definitely related in many ways and should be so considered, NRA experience indicates that separate administrative bodies should be provided for negotiations and for compliance activities, both in the field of labor provisions on the one hand and of merchandising problems on the other."

The committee which made the report consisted of Prof. John M. Clark, Columbia University; William H. Davis of the New York law firm of Pennie, Davis, Marvin & Edmonds; George M. Harrison, president, Brotherhood of Railway and Steamship Clerks; and George H. Mead, president, Mead Corp., Dayton, Ohio. The committee also included Secretary of Commerce Daniel C. Roper, Secretary of Labor Frances Perkins and Secretary of Agriculture Henry Wallace.

## Toledo Textile Workers' Strike Settled by Raise

A brief strike of United Textile Workers at the Textileather Corp., Toledo, suppliers of artificial leather for several automotive manufacturers, involving 5000 workers was settled by granting a five cent pay increase.

## GM, Ford and Chrysler Among First 10 in Newspaper Linage

For the second consecutive year General Motors in 1936 was the largest user of newspapers, according to *Printers' Ink*. Using figures copyrighted by Media Records, Inc., and others compiled by the Publishers' Information Bureau, 342 national advertisers that used more than 150,000 lines of newspaper advertising in 1936 against 302 in 1935 are listed. These figures are for 388 daily and Sunday newspapers in 100 cities.

In the order named the following are among the 10 leading advertisers in newspaper linage for 1936: R. J. Reynolds Tobacco Co., Liggett & Myers Tobacco Co., American Tobacco Co., Ford Motor Co., P. Lorillard Co., Chrysler Corp., Lever Brothers, Seagram-Distillers Corp., and the Schenley Products Co.

**V. P. (VINCE) RUMELY,** divisional superintendent, Hudson Motor Car Co., resigned this week and will take up his new duties with a Chicago organization. Mr. Rumely has been a Hudson factory executive for 21 years. He has been actively engaged in SAE work, having served as vice-president in charge of the Production Activity and is now leaving his post as chairman of the Detroit Section, SAE.

**ROBERT F. VOGT,** assistant chief consulting engineer of the Allis-Chalmers Manufacturing Co., Milwaukee, since 1921, has been appointed chief consulting engineer to succeed the late J. F. Max Patitz. Mr. Vogt is a graduate of the Swiss Polytechnicum at Zurich. His professional career in the U. S. began in 1903 and he has been with Allis-Chalmers since 1907.

**T. H. KEATING,** for the past three years Chevrolet Midwest regional manager with headquarters in St. Louis, has been named to fill one of the two new sales managerships created by Chevrolet. He will have charge of the new used car operation for the eastern half of the U. S.

**W. G. LEWELLEN,** formerly director of mass selling in Chevrolet's central office, has been appointed to fill one of the two assistant sales managerships in charge of the new used car operation, which he will direct for the western half of the U. S.

**CHARLES F. NEWPHER,** formerly sales manager of the bolt and nut division of Republic Steel, has been appointed assistant to the president of the National Screw and Manufacturing Co., Cleveland.

**H. J. HUDSON** has been appointed manager of parts and merchandising of the Hudson Motor Car Co. He has been with the company's national service organization for the past three years.

**E. J. BLUM,** a veteran employe with 21 years of service with the Hudson Motor Car Co., has been named technical service manager of Hudson.

# Business in Brief

**Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES**

General business activity advanced substantially last week and was especially stimulated by the full resumption of operations in the automobile industry after the strike. The index of business activity compiled by the **Journal of Commerce** stood at 100.4, passing the 100 mark for the first time since the middle of December, as compared with 97.9 the week before and 79.4 for the corresponding period last year. Many observers believe that the improvement in business during the coming weeks will surpass that so far this year. An upturn in both wholesale and retail trade is anticipated in view of the early incidence of Easter this year.

### Carloadings Continue to Gain

Railway freight loadings during the week ended Feb. 20 amounted to 714,884 cars, which marks an increase of 23,266 cars above those in the preceding week, a gain of 128,397 cars above those a year ago, and a rise of 161,719 cars above those two years ago.

### Power Output 13.4% Higher

Production of electricity by the electric light and power industry in the United States during the week ended Feb. 20 was 13.4 per cent above that in the corresponding period last year. The greatest increase was registered in the central industrial regions, where the advance was 17.6 per cent, while the next largest upturn was in the New England States.

### Farm Market Good

The Bureau of Agricultural Economics has recently stated that the outlook for demand in the agricultural industry this year is good in view of the evidences of expanded consumer purchasing power. It was pointed out that the improvement in recent months in industrial activity promises a strengthened domestic demand for farm products, but that there are no immediate prospects of a heavier demand from abroad.

### Oil Production Steady

Average daily crude oil production for the week ended Feb. 20 amounted to 3,295,950 bbl., as against 3,286,050 bbl. for the week before and 2,779,200 bbl. for the corresponding week last year.

### Fisher's Index

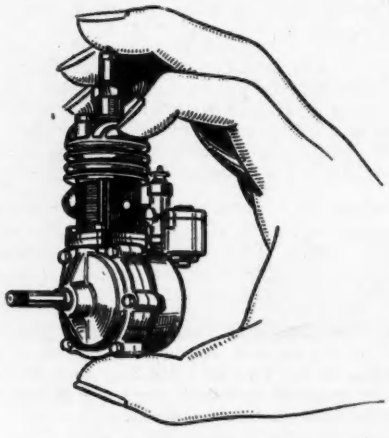
Professor Fisher's index of wholesale commodity prices for the week ended Feb. 27 stood at 90.9, as against 91.0 the week before and 90.7 two weeks before.

### Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended Feb. 24 showed an increase of $1,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and government securities remained unchanged. Money in circulation increased $21,000,000, and the monetary gold stock advanced $22,000,000.

## World's Smallest Engine Built for Model Planes

What is said to be the smallest internal combustion engine in regular production is known as the Terrot, which is built in Dijon, France. It is a single-cylinder, vertical, air-cooled, two-stroke engine of 18 mm. bore and 20 mm. stroke (0.709 by 0.788 in.), which makes its displacement 0.3 cu. in. As shown by the illustration (reproduced from *L'Officiel de l'Automobile, du Cycle et de la Motocyclette*), the engine can be easily held between the thumb and the index finger. It is equipped with a 10-mm. spark plug and a Gurtner carburetor. The piston is of cast iron and without rings. The cylinder is an iron casting and the cylinder head an aluminum casting. The crankshaft is supported in plain bearings. This engine, which is said to be an exact reproduction in miniature of a 10.5-cu. in. motorcycle engine, is intended for model planes.



**World's smallest engine has piston displacement of 0.3 cu. in.**

## *Vincenzo Lancia*

Vincenzo Lancia, Italian automobile manufacturer, died at Turin, aged 55. Attached to the Fiat racing department from 1904 to 1010, Lancia teamed with Nazzaro and Wagner and took part with conspicuous success in all the big road races in Europe and America.

In 1910 he started business in Turin as an automobile manufacturer and revealed outstanding qualities as an engineer and as a business man. His engineering ability made him prefer quality to quantity, and even after the World War, when all Europe was being stampeded into mass production he refused to depart from his policy of building up a sound business on quality only. Because of this, the Lancia company has never known any periods of financial difficulty.

Among the more outstanding engineering accomplishments of Vincenzo Lancia was independent wheel suspension, which he was the first to put into production in Europe and one-piece chassis and body construction. The narrow angle V-type motor was another of his original designs. Although overshadowed in size by Fiat, the Lancia factory is one of the most modern and best equipped in Italy, if not in Europe. More recently he opened a factory to produce his cars in France.

## O'Dea Graham Distributorship Ends

By arrangement with James M. O'Dea, Inc., the Graham-Paige Motors Corp. on March 1 began dealing directly with retail dealers in Detroit and 20 adjacent counties, it was announced by F. R. Valpey, Graham vice-president and general sales manager. The factory parts and service department will be continued at 5940 Cass Avenue, the location of the O'Dea company, and a dealer will shortly be appointed by the factory to take over retail sales at that location, it was said.

## *40 Years Ago*

**with the ancestors of AUTOMOTIVE INDUSTRIES**

The Vim Cycle Co., 331 Wabash Avenue, Chicago, Ill., are manufacturing a small motor carrier for the United States mail service.

The Winton Motor Carriage Co. is being organized at Cleveland, Ohio, with a capital stock of $200,000 to manufacture the Winton motor carriage.

Steps are being taken in Boston, Mass., to start a company for the purpose of placing on the market a steam wagon built in the shop of George E. Whitney of East Boston.

The American Electric Vehicle Co., of Chicago, Ill., are constructing a large factory at New Chicago, Ind., where they will be enabled to turn out their product complete and in large quantity.

The biograph, the new instrument which photographs life, or objects in motion, was recently focused on the famous self-propelling fire engine, owned by the city of Hartford, Conn., and some remarkably fine views of the ponderous machine in action were obtained.

—From *The Horseless Age*, March, 1897.

# Automotive Metal Markets

## *Higher Wages and Shorter Hours in Steel Industry Will Lift Prices $2 to $6 per Ton*

By William Crawford Hirsch

Developments in the last few days have prepared the steel market for announcements of higher prices. With wage increases and shortened work weeks granted by a number of the "independent" producers, a rise in prices for all descriptions of steel, thought highly improbable only a few weeks ago, was generally looked for as inevitable. The market's interest centered chiefly in what the extent of the advances would be, predictions ranging from a $2 rise in the price of some products to $6 a ton in others. Because wage scale negotiations were pending at the usual time for announcement of the next quarter's prices and opening of order books for that term, the chief subsidiary of the leading producer deferred making public the new price list until later this week.

Meanwhile output has been speeded up at all ends of the steel industry to rush shipments of what steel is still due to buyers at fourth quarter prices, $3 to $4 a ton below those now in effect and perhaps twice that below what second quarter prices will be. Steel output is now at close to 200,000 tons a day. The American Iron and Steel Institute reports mills operating this week at 85.8 per cent of capacity, compared with 82.5 per cent last week, the rate being undoubtedly the highest since October, 1929.

Some of the producers voiced the opinion early this week that price advances should be made immediately effective, so as to do away with the carrying over from one quarter into another of orders for heavy tonnages bought at lower prices. So radical a change in marketing methods met, however, with considerable shaking of heads in more conservative quarters. It is quite possible, however, that the placing of any but routine commitments at first quarter prices for shipment before April 1 will be frowned upon by mills generally, so as to insure billing at the higher prices as soon as possibe after the increase in steel mill pay-rolls. Higher prices for automobiles are thought by steel men to be unavoidable under the circumstances and the public's reaction to these, it is well recognized in the steel market, will exert as much influence on the future of the steel industry as on that of the automobile manufacturers.

**Pig Iron**—Booking of second quarter business at the $1 per ton advance, that went into effect in the Middle West markets last week, is under way. Predictions of further advances are supported by the rising tendency in steel prices, heavy export demand and the possibility of higher 1937 ore prices. The Ford Motor Co.'s inquiry for its ore requirements calls for 315,000 tons, compared with 490,000 tons last year.

**Aluminum**—The sole domestic producer of primary aluminum advanced on Monday the base price for ingots one cent per pound to 20 cents for metal of 99 per cent plus purity. Special high purity metal and small lots of 99 per cent are quoted at 21 cents, with no increase. The rise in the base price for ingots was preceded by announcement of higher wage scales. Secondary aluminum manufacturers promptly revised their prices upwards in keeping with the advance in primary.

**Copper**—With the London market slightly lower, but still highly speculative, the situation here has eased off and copper is in somewhat better supply. In the "outside" market, however, ½ to ¾ cents premium over the producers' 15-cent quotation was still asked at the beginning of the week.

**Tin**—The market is a shade weaker, with spot Straits offered early this week at 54⅛ cents.

**Lead**—Following sharp advances late last week, the market has settled down on a basis of 7 to 7.05 cents, New York.

**Zinc**—Steady and unchanged.

# Notes from Nippon

The Osaka Taxicab Co. of Osaka, Japan, has decided to operate Toyota passenger cars in preference to Fords. The company has hitherto used Ford cars exclusively.

The Hitachi Works which has been training workers during the past few months for the manufacture of Diesel cars at the plant near Sukegawa, in Ibaragi Prefecture, is now ready to go into production in the new plant. Under the initial program 30 units of Diesel buses and trucks will be built and later 3000 per annum are scheduled.

The keen demand for "Datsun" half-ton trucks, which are the commercial edition of the tiny "Datsun" passenger car, is reported to have influenced the Nissan Jidosha to increase output to 12,000 units a year, an increase of 5000 over the present capacity. The company, however, is hardly in a position to meet the demand unless the promising baby passenger car line is dropped.

The Toyo Kogyo K . K. (Far Eastern Industry, Ltd.) has increased its paid-up capital to 5,000,000 yen in order to take up the manufacture of automotive vehicles on a larger scale. The company has been manufacturing the peculiar type of rear-engined cars known in Japan as "Sanrinsha." Standard passenger cars will be added upon completion of a new plant. The Toyo Kogyo is affiliated with the Japan Nitrogen Fertilizer, of Osaka.

## January Car Sales Are 29% Ahead of Year Ago

New passenger car sales in the United States for the month of January ran 29.15 per cent ahead of the same month in 1936, based on registration returns from 37 states. This is summed up in the R. L. Polk & Co. report issued this week.

To date, in the 37 states reported, total sales for January are 192,896 compared to sales totaling 149,354 for the same number of states a year ago. This figure, however, is 10.77 per cent less than sales for 37 states in December when the total was 216,181. The Polk estimate of 280,000 sales in January will be well below the total sales of 327,303 reported for December.

Truck and commercial car sales in January are running ahead of the same month last year as well as December. To date in 37 states there have been 32,085 sales. This is 10.9 per cent higher than the same month last year and 18.1 per cent higher than in December. December truck sales totaled 42,208, while the Polk estimate for January is 48,500.

## Autocar Adds Night Shift

Production was greatly increased at the Autocar factory, Ardmore, Pa., during February by the addition of permanent night crews, and the Autocar Co. enters March with a record-breaking volume of unfilled orders, according to the president, Robert P. Page, Jr.

**The novel interior of Maj. Edward Bowes' new Chrysler Airflow was designed by F. A. Selje, Chrysler's chief body interior designer. An electric motor raises and lowers the glass partition separating the front and rear compartments. The console installed in this partition groups barometer, clock, compass and altimeter. Above these are humidors, cigar lighter and ash trays and on each side are compartments holding bottles and glasses**

# GM-Labor Conference Nears End

## *Union's Demand for Uniform Minimum Wage, Regardless of Locality, Only Remaining Point of Difference*

Nearing the end of its collective bargaining negotiations, the General Motors conference with the United Automobile Workers Union is snagged on the question of a minimum wage. That is the only point remaining unsettled of the six union demands scheduled for negotiation in the conference that grew out of the strike settlement. Of the eight original demands made on GM by the union, two were disposed of in the agreement ending the strike. These were the requests for a conference and union recognition.

Tentative agreement has been reached on the other five points involving the question of a 30-hr. week, abolition of piece-work, reinstatement of employes claimed to be unjustly discharged, seniority and speed of production lines. Announcement of conclusions reached on these points will not be made until the conference is ended, but it is understood that no further discussion is needed except for the wording of the final draft of the agreement. The union is said to have abandoned its demand for a 30-hr. week.

According to a GM spokesman, a stumbling block in the present wage negotiations is the insistance of the union upon a uniform wage rate for all employes regardless of types of work, experience, skill, ability, sex, race or the geographical location in which the work is performed.

The union holds that the differential should be in the wage scale and not in the minimum, charging that GM is the only large automobile manufacturer that does not already have a uniform minimum rate. "GM rates go as low as 40 cents an hour," said Wyndham Mortimer, a union conferee.

Mortimer issued the following statement outlining the union's position on uniform wages: "The union demands for no discrimination in wages because of differences in sex, race, color, or location of the plant are made in the name of justice and common sense.

"We hold that a woman doing the same work as a man (or just as valuable work) and a Negro doing the same work as a white man should be paid equally for that work, all other conditions being equal. Their services have equal value to the company—their compensation should be the same.

"Further we hold that the differences in cost and standard of living between various sections of the country are not factors to determine wages paid by General Motors in those sections.

"First, living standards are low because wages are low and will remain so until wages are raised to a par with wages in other sections.

"Secondly, General Motors sells the cars made by workers in Atlanta, Ga., and Memphis, Tenn., for the same price and at the same profit as those made by workers in Detroit and Flint—the workers in the Southern sections contribute just as much to the car's value and the corporation's profit as those in the North, no matter how much lower their cost of living is. Why should General Motors, rather than the workers, profit from this difference in living costs?"

At the conclusion of Wednesday's session, C. E. Wilson, GM vice-president, briefly stated the corporation's position: "There are three factors to be considered in setting wage rates. These are continuity of employment, cost of living in the locality and competitive conditions. We do not want to have our rates out of line with prevailing rates of pay in any community. The cost of living in some communities is less than in Detroit and that should bear some weight. We think it is right to pay more in a body plant where workers may be laid off for six weeks or so in a slack season than in a plant which operates steadily for 12 months."

"We are trying to put a bottom on the wage structure of the industry," explained Ed. Hall, union conferee.

Negotiations will continue until an agreement has been reached on all points, and observers were of the opinion that this goal was not many days away.

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# :SLANTS:

FREE TRIP—*As the millionth passenger of American Airlines, Theodore Colcord Baker, 46-year-old automobile dealer of Brookline Mass., won a free trip to Europe on the Hindenburg with the choice of returning either on the Normandie or the Queen Mary. Mr. Baker had his first airplane flight in* 1910 *and in recent years has used planes frequently for business travel. He took over the Ford agency in Brookline after the war and under his ownership it has become one of the largest in New England.*

CRAFTSMEN—*Original motor car designs represented by models submitted in a nation-wide competition will be sought by the Fisher Body Craftsman's Guild this year as a means of developing the creative genius of American youths. Four* $5,000 *university scholarships and other awards totaling more than* $80,000 *are posted for this contest and the Napoleonic coach-building competition. The latter is being continued this year with more awards than were given last year.*

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## Chrysler-UAW Talks

(*Continued from page 379*)

and their resignation, according to Frankensteen, means the abolition of the Chrysler Works Council.

Those resigning numbered 48 out of 53 members on the Dodge employe representation board; 12 out of 12 from the Chrysler Kercheval plant; 9 out of 15 from the Chrysler Jefferson Avenue plant; 7 out of 8 from Dodge Truck; 21 out of 44 from Plymouth; and 6 out of 8 from De Soto.

The first meeting was on a friendly and amicable basis, according to both sides. "This is another step toward a general understanding with the automobile industry," said Homer Martin at the conclusion of the first session. "Other steps will follow in logical sequence as other parts of the industry recognize the union and deal with it." Asked if he referred to the Ford Motor Co., Martin said: "This statement does not exclude Ford."

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## Spring Demand Boosts Output

(*Continued from page 379*)

wind up as the fourth largest in history, exceeded only by March, April and May of 1929, when production ranged from 626,076 to 663,811 units.

February finished stronger than had been expected. GM's quick come-back bolstered output in the final week so that the industry's official figure for the month is likely to be upwards of 375,000 cars and trucks. This makes the estimated total for the first two months this year at least 775,000 units which, with the March projection, indicates a first quarter output of better than 1,350,000 units or more than a 20 per cent gain over the corresponding period of 1936.

Pontiac motors on March 2, had its first 1400 day since the spring of 1929. According to H. J. Klingler, general manager, there will be several more days this month which will show a production of 1400 cars or more. Employment has reached a peak again and it is expected that the month's production total will reach the 30,000 mark, which will be an all time mark for Pontiac.

Willys-Overland Motors, Inc., output for February was 8599 cars or a 30 per cent gain over January, and brings the total for the current model to 19,207 units. D. R. Wilson, president, said the factory now has 4500 employes. Heaviest demand is for the deluxe sedan, sales reports show.

Buick retail sales during the first 20 days of February totaled 3309 units, 1518 of which were delivered to customers during the second 10 days of the month. This compared with 3687 cars delivered during the same period last year of which 1981 were delivered during the second 10 days. Orders at the Buick factory jumped from 29,412 to 37,131 this week representing a record wholesale demand. Since the introduction of the new cars, Buick normally has carried a bank of from 20,000 to 30,000 orders on its books. At the same time, retail orders with individual dealers jumped from 14,854 on Feb. 10 to 17,083 on Feb. 20, the bulk of the increase coming during the last few days of the period. With output now on a basis of more than 1000 cars a day and expected to average in excess of 1200 cars a day in March, shipments are going forward on a basis to meet the heavy demand, it was said.

### Show Dates

| | |
|---|---|
| Akron | Nov. 6-13 |
| Baltimore | Nov. 13-20 |
| Brooklyn | Nov. 6-13 |
| Buffalo | *Oct. 30-Nov. 6 |
| Chicago | Nov. 6-13 |
| Cincinnati | Oct. 31-Nov. 6 |
| Cleveland | *Nov. 13-20 |
| Columbus | Nov. 6-13 |
| Detroit | Nov. 6-13 |
| Jersey City | *Nov. 13-20 |
| Kansas City | Nov. 6-13 |
| Milwaukee | *Nov. 13-20 |
| Newark | Nov. 6-13 |
| New York | Oct. 27-Nov. 3 |
| Philadelphia | Nov. 6-13 |
| Pittsburgh | Nov. 6-13 |
| St. Louis | Nov. 14-21 |
| Springfield | *Nov. 13-20 |
| Toronto | Nov. 6-13 |

* Tentative.

## Parts Strikes Spread

(*Continued from page 379*)

as sole bargaining agent, time and one-half for over eight hours a day, 40 hours a week, double time for Sundays and holidays, no discrimination against union members, and return of discriminated workers to jobs.

Motors Products' workers are demanding a blanket 10 cents an hour increase and minimum wage of 75 cents an hour. This plant, where 3600 workers are employed, has been the scene of several strikes in the past. It now appears likely to be completely and permanently organized for the first time in its history. Motor Products manufactures windshields, window ventilators, hoods, fenders, mufflers and numerous other parts, principally for Ford and Chrysler, but for practically all other automobile manufacturers also except General Motors.

Seven hundred are employed at Zenith Carburetor, where carburetors are made for tractors and marine and industrial engines. Demands include a 10 cents an hour increase and the establishment of a minimum wage.

Timken Detroit Axle Co. also obtained an order from Judge Campbell to show cause why 400 sitdown strikers should not be evicted from its Plant No. 1, where a strike was started Feb. 23. The order was read to the strikers Tuesday morning. The plant employs approximately 1700 men and women.

A strike was started Monday in the plant of the Advance Stamping Co., manufacturers of automotive and radio parts, employing about 170 men and women. According to the management, demands were made by 25 employes for recognition of the UAW as their bargaining agency, elimination of piece work, higher wages and rehiring of a discharged worker.

Murray Body manufactures bodies principally for Ford. About 5000 are employed at the main plant where the sitdown is taking place. Their demands include an 80-cent minimum wage for men and 75 cents for women.

Production was resumed at Murray Corp. Thursday morning, after what was said to be the largest sitdown strike ever staged in one plant in this country, although it lasted only a day. More than 2000 workers remained in the plant, but evacuated it when the management agreed to rehire 34 union members who had been discharged and negotiate with a union committee on wages, hours and working conditions.

Strikers who have held the Ferro Stamping and Mfg. Co.'s plant for two weeks agreed to evacuate Thursday morning under the terms of a truce which calls for negotiation to begin on Saturday. Operations were to be resumed Friday.

A new sitdown strike halted production at the Mack Avenue plant of Briggs Mfg. Wednesday night, with the union charging that the Briggs management disregarded an agreement reached several weeks ago and that the production line was being speeded up. Strikers evacuated the plant early Thursday morning. Terms of settlement were given as follows:

"We hereby agree that we will meet with any committee you may designate to discuss the particular grievances as outlined in Mr. Martin's telegram of March 3, provided you will agree to the following:

"1. That all men leave our plant by 6 a. m.

"2. Production will start as usual on March 4.

"3. Production will be continued at the usual rate without interruption by further sitdown strikes until conferences with your committee have ended. We will need a few days to make a thorough study of the grievances submitted and will start conferences with the committee not later than March 15 and sooner if possible."

Production was tied up at three Bohn Aluminum Co. plants Thursday morning by sitdown strikes involving 1200 men on day shifts.

Sitdown strikes were started Wednesday at Zenith Carburetor Co., O and S Bearing Co., and Allied Products Co.

The epidemic of strikes in the Detroit area, affecting almost every type of industry, has placed a heavy burden on both the CIO and AFL unions and the two rival groups temporarily have forgotten their differences. Appeals for organizers and assistance have come from many unorganized groups. The two unions have cooperated in supplying aid to strikers who in many cases have been taken over by AFL craft unions. Designation of the UAW as bargaining agent for its members in a stove plant and appeals from workers in other industries having no connection with the automobile industry has prompted union officials to consider the formation of a miscellaneous CIO unit in Detroit.

George A. Krogstad, commissioner of the State Department of Labor and Industry, was sent to Detroit by Governor Murphy to act as mediator in any labor controversy in which management and men requested his assistance. He has set up office in the Transportation Building and will remain on call day and night. His first task involved mediation in a laundry strike.

## Graham Raises Wages Five Cents per Hour

Effective March 1, the Graham-Paige Motors Corp. increased wages of all hourly workers 5 cents an hour. Approximately 2500 employes are affected. This follows a similar raise given Dec. 1 last.

# White to Double Capacity

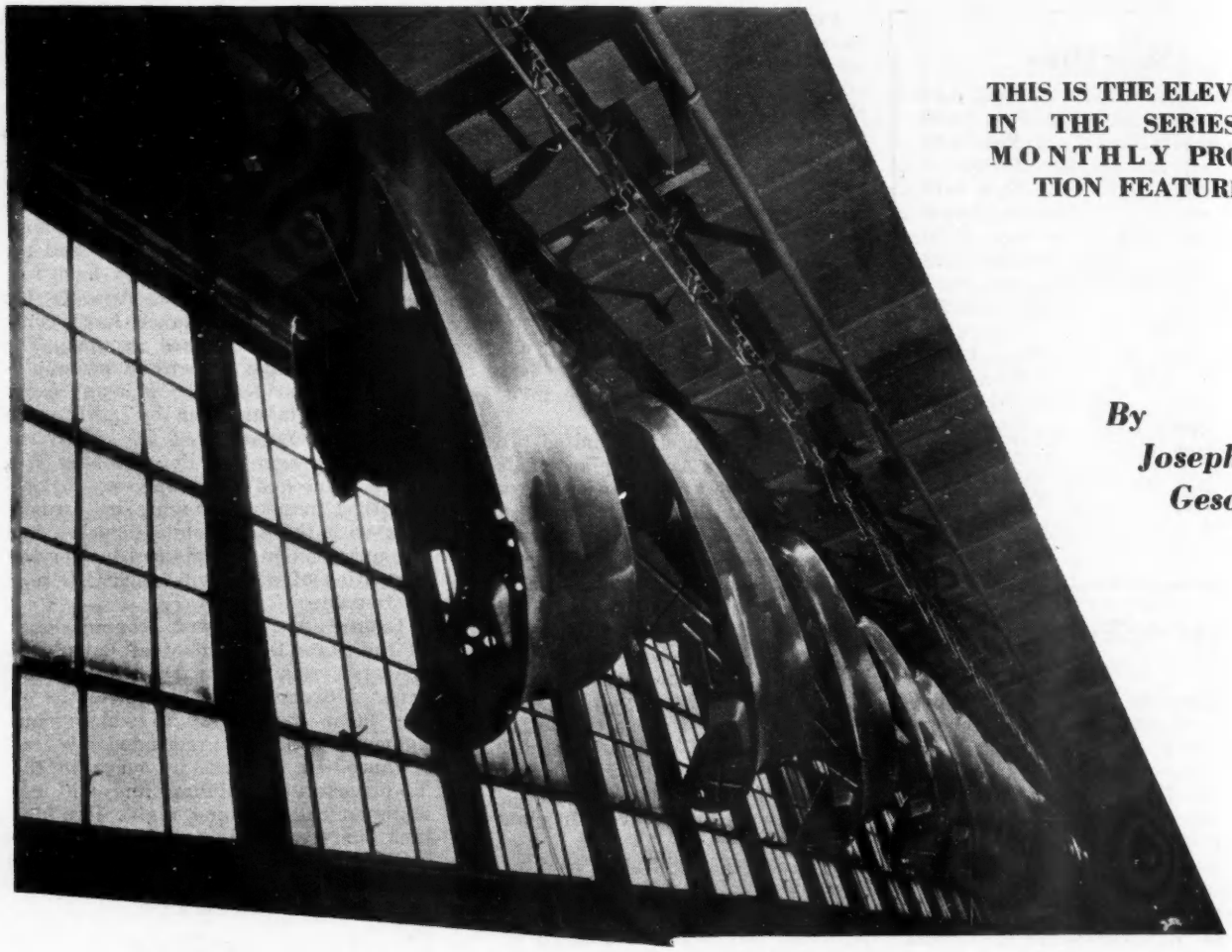
### *$2,000,000 Expansion Program Will Also Provide Plant for Building Bus Bodies*

Plans for the largest expansion program ever undertaken by the White Motor Co. were revealed this week when Robert F. Black, White chief executive, announced that more than $2,000,000 will be spent within the next year and a half for new machinery and tools, property repair, building construction and the installation of a complete new plant for the building of heavy-duty coach bodies for city service.

Most important items in the plan are those calling for the construction of a spacious combination testing plant and research laboratory, and the bus body building division; purchase and rearranging of new machinery, tools, and heat-treating equipments; dynamometers for engine testing, creation of greater storage facilities, and general property improvement.

Keeping pace with the planned expansion, employment at White is at its highest level since December, 1930. All shifts have been increased and figures show the addition in Cleveland of 924 employes since February, 1935, an increase of 40 per cent. Of this number, 450 have been added since Jan. 1.

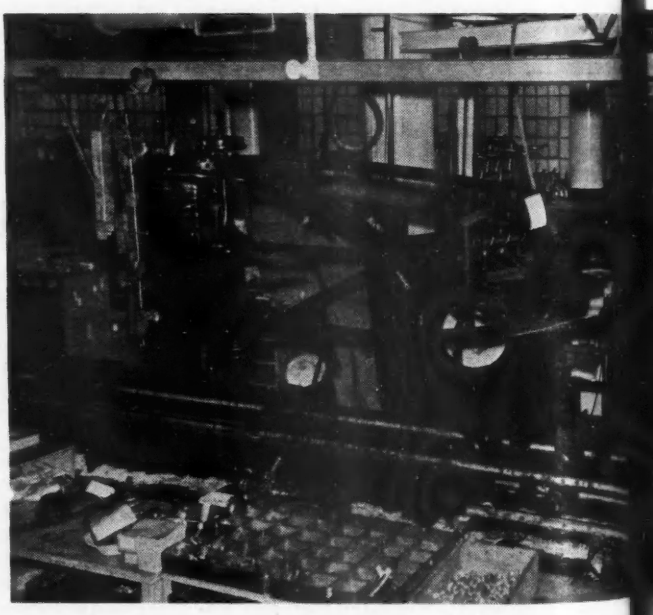
Outstanding single item in the program is the creation of the bus body building department, a move warranted by unprecedented increase in the sale of 12-cylinder "pancake" engine buses for city service. The new heavy-duty coach body building will occupy the more than 140,000 sq. ft. of space formerly utilized by the Cleveland district office at East Seventy-ninth Street and St. Clair Avenue. The Bender Body Co., which has been supplying a great part of the heavy-duty bodies used on White coaches, will continue to supply the company with light-duty and intercity coach type bodies.



THIS IS THE ELEVENTH IN THE SERIES OF MONTHLY PRODUCTION FEATURES

*By Joseph Geschelin*

**(Above) Bird's eye view of small section of Cadillac materials handling system showing fenders moving on the overhead conveyor at ceiling height**



SOME thirty years ago European automobile experts applauded in sheer amazement the spectacle of three American cars which were dismantled after test runs, their component parts scrambled together, and then three cars assembled from the heap of parts under the watchful eyes of official observers. This incident—one of the classics of the automobile industry—was provided by Cadillac, establishing in its early beginnings a tradition of quality and interchangeable manufacture.

Cadillac was one of the first to use Johansson gage blocks in this country and the original set is still a part of its gage laboratory. Jo-blocks were the basis for the new principle of interchangeability which, today, is an accepted basis for all mass-production.

If one is fortunate enough to see behind the scenes at the Cadillac Motor Car Co., he will note the guiding influence of Nicholas Dreystadt, its president, whose uncommon grasp of management and technical detail is responsible not only for the type of manufacturing that is now characteristically a Cadillac development, but for an unusual product that has taken hold of the public's imagination so dramatically. As Mr. Dreystadt puts it—"We are in a price market from $1,000 up and we have no ceiling. From a merchandizing point of view, we intend to give our public exactly what it wants; and in the higher priced cars our policy is to build more and more custom work rather than less and less."

With such an objective it becomes of more than passing interest to discover what has been done to produce a line of high-priced cars with the smoothness and precision found at Cadillac, particularly when this is accomplished at lowest cost levels in the history of the company.

To put it another way, consider that

# Cadillac Production Keyed to Quality Products at Lower Costs

## *Flexibility in departments coordinates operations of varying and dissimilar traits on the three lines of models*

In 1933 the LaSalle V-8, 4-door sedan carried an f.o.b. price of $2,245 (with trunk extra). In 1934, the first LaSalle straight eight carried an f.o.b. price of $1,695. Today the 1937 LaSalle, back to a V-8 powerplant, and built-in trunk body, features a price of only $1,145.

Public acceptance is a fair estimate of the success of any program. The fact that Cadillac has it in full measure this year is evident from the figures. In 1936, Cadillac built a total of 28,235 units; in the first six weeks of the life of the 1937 line, they had shipped 10,000 units of the LaSalle alone.

These figures place a new significance upon the manufacturing philosophy of this organization and give us a better appreciation of the intrinsic worth of this organization.

Looking back but a few years, we find that Cadillac was building no less than 7 or 8 different chassis in decentralized manufacturing departments located all over the plant buildings. It was not unusual to find many parts backtracking from floor to floor, weaving a tortuous path from the raw materials to final assembly. Moreover, in addition to a foundry building on the premises, there was another foundry in another part of Detroit.

When the LaSalle was added to the family what was more natural, at the time, than to build a new factory for the newcomer.

These things were all in the background when Nicholas Dreystadt assumed the presidency of the company in 1934, after a preparatory period of service as national service manager and finally as Cadillac factory manager from 1932 to 1934. A revolutionary change was indicated if he were to carry out his ideals of quality manufacture at lower cost to the public.

The first step was a general simplification and rationalization of the production process. And as will be described later, this was intimately related to a closer and more intimate coordination of engineering design and factory operations. In inaugurating the new program it was decided definitely that all manufacturing must be

**(Center) Positive, three-point fixture mounted on overhead beam is used for chassis turnover. It's quick and safe to use**

**Final inspection line where watchful eyes make sure that "they shall not pass" unless they are 100 per cent right. In the foreground is a group of 1937 LaSalles**

concentrated within the most economical area by recasting production departments about a normal and straight line flow of materials from the receiving to the assembly lines. As a result, the La Salle plant was immediately abandoned and with it went the separate foundry building.

Since we intend to analyze the present set-up in detail later in the article, we can confine ourselves to a generalization of what was accomplished. Coordination was not a simple matter when we consider that the Cadillac line includes the LaSalle which is essentially a mass production job—the V-12 line, essentially job-mass-production—and the V-16, essentially a job lot proposition. Any single type of manufacturing process regardless of its character can be readily handled, but the coordination of the three basic and dis-similar processes posed a difficult problem of intriguing complexity.

The first requisite was flexibility in manufacturing departments and on assembly lines, so today all V-8 chassis and units including LaSalle, are built over a single mass-production layout compact as to floor space and resulting in the elimination of much of the older items of equipment. V-12 and V-16 units are built side-by-side with the V-8's, in the same departments, but on parallel lines of all-purpose machinery fitted with interchangeable, removable heads.

But flexibility has been carried far beyond these immediate considerations. The plant is equipped with Bull-Dog power ducts which can be plugged in anywhere and since each machine is individually driven, it is now possible to move machinery at will at any time with little expense or complication. Moreover, in most production departments, two open aisles are provided which play an important part in the scheme of things. During the regular periods of change-over from the old to the new, the aisle space can be used either to try out new equipment or as a means of housing some of the old equipment to permit an uninterrupted flow of production while the department is being rearranged.

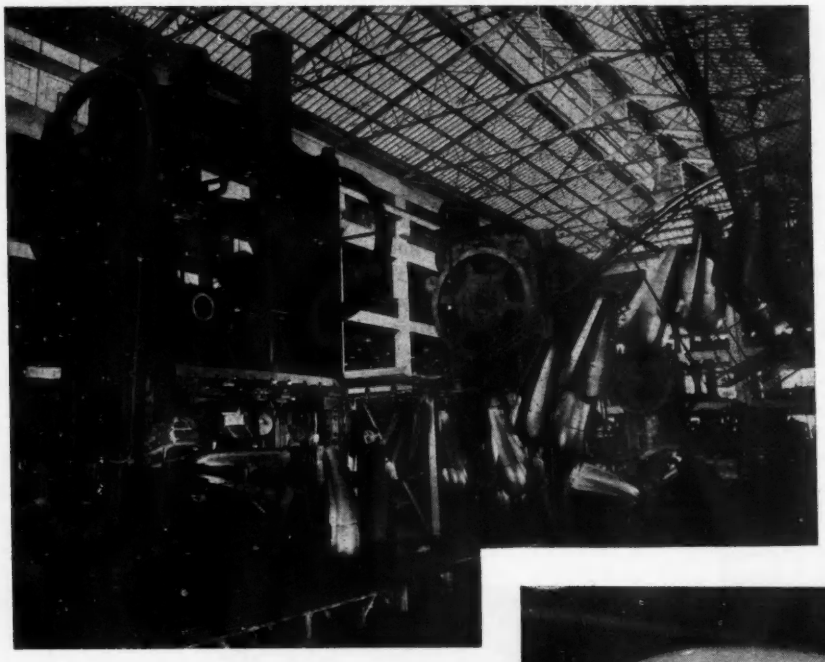
Cadillac has a very definite equipment policy which should be of interest to production people. Under Mr. Dreystadt's direction, there is a constant search for improved equipment, for new processes, and in general, a conscious seeking for those things that contribute to improvement in quality of the product.

## Introductory Details

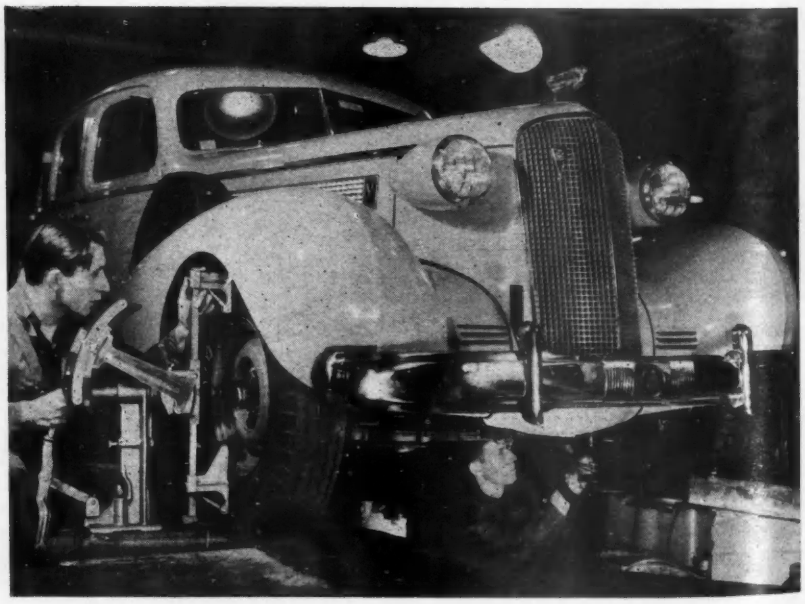
The Cadillac factory covers 49.2 acres of ground and has a floor space of 3,083,900 square feet. On the average it employs about 4100 factory workers. As a manufacturing unit it is self-contained and self-reliant, since all parts are fabricated on the premises and practically all castings are made in its foundry.

To acquaint our readers with the personnel of this organization, we have shown a table giving a complete list of the factory executive staff together with their departmental responsibilities. Another table summarizes some of the major conveyor lines together with the developed length of each line.

Engineering planning is responsible for the fact that the entire line of V-8 engines is made from the same casting and with similar mounting dimensions. This in turn made it possible for the production department to produce a compact mass-production



**General view of press shop conveyor lines with Toledo press prominent in the foreground**



**Front wheel alignment on LaSalle and Cadillac V-8's is established and checked at this station using new Bean machine**

(Right) New Cincinnati all-steel shear handles square-shearing of blanks in press shop. Unique holddowns and built-in sizing device have increased productivity and improved dimensional accuracy

(Bottom Page) Fireworks begin when this new Federal flash welder goes into action. One of the machines used to weld front and rear stampings of front fender into a single unit

(Left) 1937 Cadillac cars approaching the end of the final assembly line

## Cadillac Factory Personnel

V. A. Olsen.....Works Manager
C. A. Raftrey .....Assistant Works Manager
F. T. Ellis .....Superintendent of Manufacturing Division as indicated by *

### Superintendents

**Production Division**

*H. A. Barber .....Engine Division
*W. F. Jacobs.....Sheet Metal Division
*F. Kupetz .....Transmission and Axle Divisions
G. A. Schwitter..Final Car Assembly
W. S. Carroll.....Chassis and Car Building
*E. H. Stilwill.....Heat Treat and Plating
H. B. Swan.....Foundry

**Non-Productive Division**

H. T. Johnson.....Methods and Equipment
H. Ford .....Standards
W. H. Frater.....Personnel
D. F. Hulgrave....Purchasing and Salvage
J. H. Lamb.....Material Control
O. J. Snider.....Inspection
E. J. Tiedeman....Traffic
H. A. Zannoth.....Plant Engineer

layout equipped with special automatic machinery designed to handle the blocks and other parts without change of setting or tooling. In fact the only difference between the LaSalle and Cadillac blocks is in the cylinder bores.

Engineering planning is responsible for a new transmission design, lighter and more compact than ever before, which is used interchangeably in all LaSalle and Cadillac chassis right through the V-12 line. The V-16, a custom-built car in most other respects has a special transmission.

Obviously, this principle of unit interchangeability assures not only the same level of quality for all cars in the line, but also makes possible some definite economies which have much to do with the lower cost level.

While on the subject of quality, we should like to note the fact that in addition to the many controls and final inspection operations, Cadillac has a unique customer sampling inspection —made personally and regularly by the president, Nicholas Dreystadt. At the end of each day a car is taken off the line, at random, and delivered to the official garage. This car is driven all of the next day by the president as a customer, not as a company official. And it's got to be good.

Let us pause for a moment and shift the scene to the manufacturing departments. It is our intention to take a quick look at the high spots and to note some of the more interesting operations and items of equipment as we go along. While it is not feasible to present a complete picture within the limitations of a single article, we can draw a broad perspective and then amplify many of the points by using condensed factory routings which give the exact sequence of operations as well as the equipment used for each step.

A carefully selected pictorial section with views from each department will aid in visualizing our word picture.

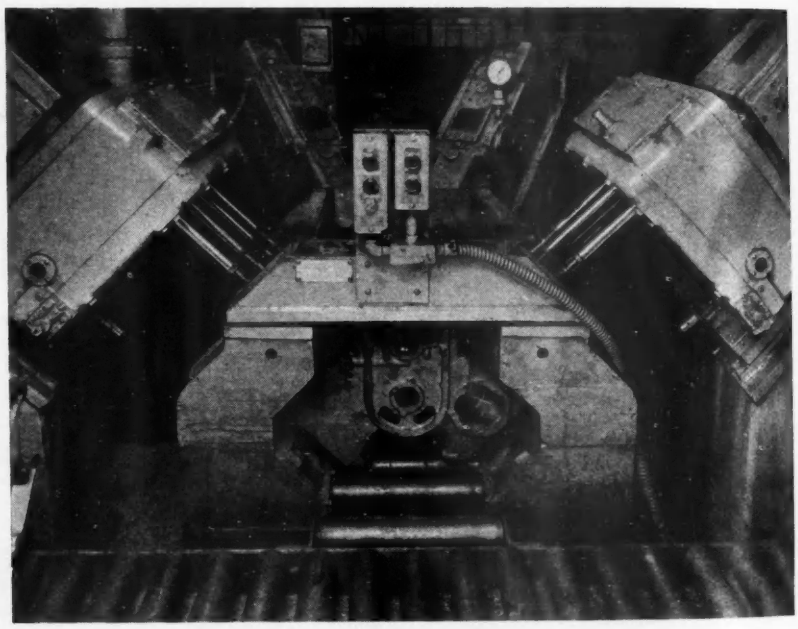
## Foundry

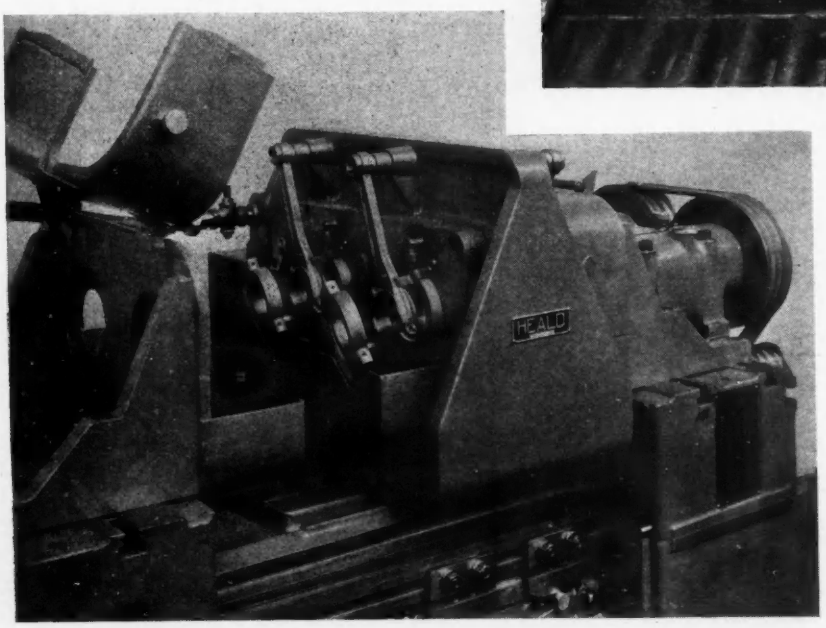
Here is a modern foundry, completely mechanized so as to relieve the operators of the back-breaking manual work usually associated with foundry operation, and equipped with four cupolas. The foundry handles both hard and soft iron, the hard iron being a special 30 per cent steel composition used for blocks and certain other castings. Capacity in hard iron is about 11 tons per hour, on the average.

There are five conveyorized pouring lines, one each for cylinder blocks, cylinder heads, flywheels, differential carriers, for manifolds and flywheel housings, for miscellaneous small parts, and for transmission cases.

Since this is a basic operation, quality control is imposed upon every step. In the first place, the metal is checked constantly by the foundry laboratory which takes samples of every ladle. The next step is to assure perfection in the difficult V-block casting. For this purpose, the dry-sand cores are made up in steel fixtures and then each core as well as the complete core assembly is checked in a steel fixture fitted with go and no-go gage pins.

When Cadillac first started production of V-blocks, some of the inherent difficulties were encountered. After much intensive research it was found that casting failures were due to stresses set up by unequal contraction of various sections during cooling. Today they get practically 100 per cent perfect castings, thanks to the installa- of the so-called "equalizing oven"






(Above) Four-way Natco drilling machine with angular heads takes group of underside holes in one setting. Counterbores plug holes in jacket face, drills—two water drain holes, oil filler bracket screw hole, and two oil holes from idler to support

(Left) Close-up of Heald double-end precision boring machine for boring large bores in new connecting rod —four rods at a time. Machine stopped and covers open to show detail

which is essentially a normalizing oven with a controlled heating cycle. Blocks are hooked onto the overhead conveyor directly from the shake-out, while still hot, and go through the controlled cooling stages for a period of 3 hours which gets the blocks down to about room temperature.

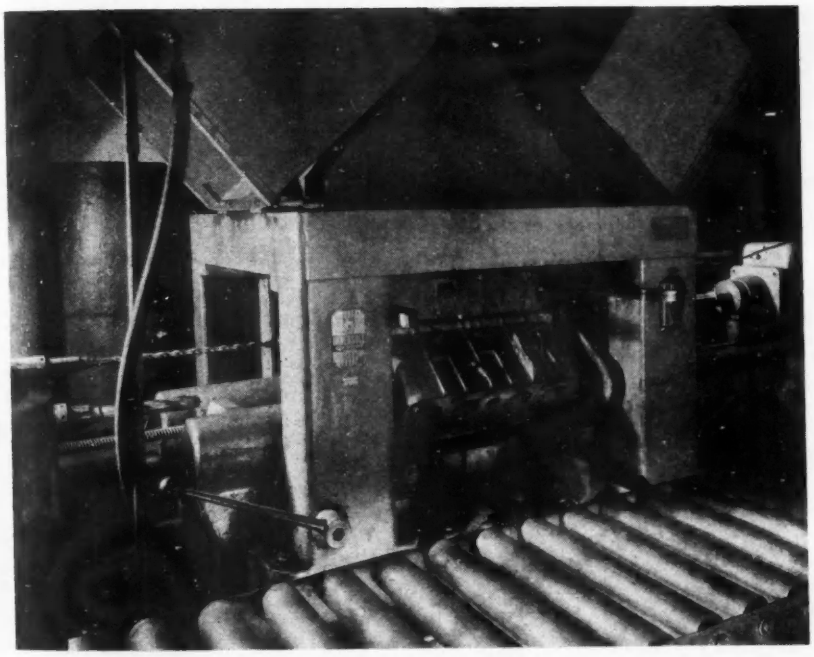
This equalizing oven is said to be the first installation of its kind in the automotive field.

Another interesting development is the use of conveyorized inspection lines in the foundry for checking dimensional accuracy of rough castings and for hardness tests on the cylinder blocks.

Foundrymen will be particularly interested to learn that Cadillac has been able to eliminate the time-honored operation of sealing castings by spray-painting to mask the deficiencies of foundry cleaning. This has been achieved by the use of the Pangborn Rotary shot-blast machine which cleans the interior surfaces so perfectly that there is no advantage whatever in a sealing coat.

## Cadillac Conveyor Line

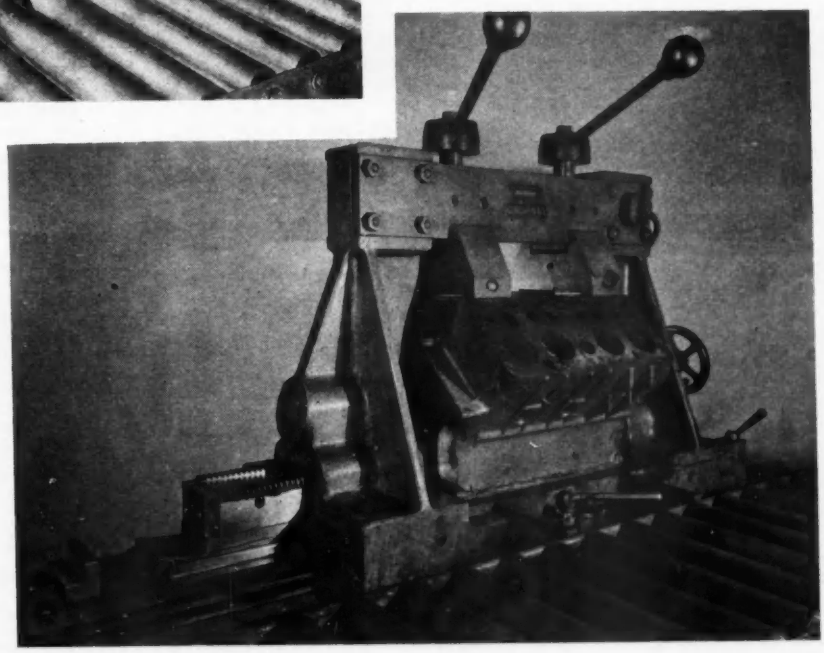
| Description | Length (Ft.) |
|---|---|
| Engine assembly line | 220 |
| Conveyor through block test | 264 |
| Engine parts conveyor to engine assembly line | 388 |
| Foundry equalizing oven conveyor | 472 |
| Sheet metal in white conveyor | 1700 |
| Bonderize and primer conveyor | 3300 |
| Duco finish line and through oven | 1980 |
| Number one chassis assembly line | 290 |
| Number two chassis assembly line | 224 |
| Number three assembly line after body drop | 371 |
| Finished car repair line and accessory installation conveyor | 500 |
| Final car wash and inspection line | 544 |



### Engine Production

The motor division has separate departments for the production of cylinder blocks, crankshafts, camshafts, and other parts, and includes in addition, the motor assembly lines.

Perhaps the most striking thing about this department is the layout for machining the V-8 blocks since it represents planning of advanced type and



**(Above) Three-way Ingersoll deep hole drill comprising unit-type fixture and Power Pack heads. Drills oil gallery hole, core drills idler hole, drills oil filler hole, and chamfers holes in oil pan rail**

**(Right) Main bearing cap locks finished by surface broaching in one pass on this Cincinnati hydraulic broaching machine**

utilizes specialized production machines of the most modern design. Apart from the novelties of equipment, a few of which will be noted more in detail, the outstanding feature of the line is the routing of all blocks over the same machines without any change in set up. The only shift comes in the cylinder boring and finishing operations, where they use the same machines, but change boring tools and hones.

V-12 and V-16 blocks are machined in the same department but on separate lines of more or less universal type of equipment fitted with interchangeable and removable multiple-spindle heads. These lines represent the job-mass-production and job-lot-production techniques and swing into action only at stated intervals as distinguished from the mass-production lines which are in constant activity.

On the V-16 in particular, where production volume is limited, the machine lines are manned by skilled mechanics who are drawn in on occasion from other departments. These are highly competent men quite capable of following a block through a complete succession of operations from one machine to another.

Since the assembly of engines also is governed by constancy or variability of movement, the V-8 is distinguished by a long mass-production line whereas the V-12 and V-16 are assembled on short separate lines.

For a complete picture of the sequence of operations on the cylinder block and other major parts of the engine we refer you to the factory routings shown elsewhere in the article. However, we have selected a few items of unusual interest and will treat them in more detail.

Undoubtedly one of the most noteworthy operations on the V-8 cylinder blocks is the use of single-point boring with cemented-carbide tools for producing holes not only true to size but perfectly round and normal to the crank journal axis. This operation is performed on the No. 45 Heald Bore-Matic, a low-level, precision boring machine having four horizontal spindles and boring one bank of the V-8 block in each setting.

In this machine, the cylinder block is placed on the platen of the fixture, and is located on two dowel pins diagonally placed on opposite sides of the block. As the work is lowered on to the platen of the fixture, it is guided to the locating pin by guide blocks.

The fixture platen is then tilted to the angular position and the center line of the cylinder bores brought in line with the boring spindles. The tilting of the platen is accomplished hydraulically and controlled by an operating lever on the rear of the fixture. As the platen starts tilting, fingers emerge from the platen and hook over the rib around the bottom of the block and prevent the block coming off the locating pins. When the fixture platen has reached its final position, two round nose centering plugs enter the crankshaft bearing holes at each end of the cylinder block from the front and rear of the fixture. These centering plugs align the crankshaft bearing holes at right angles to the table travel and the finished cylinder bores. The cylinder block is clamped in its final position by a horizontal slide under the platen that auto-

## Factory Routings for

| OPERATION | EQUIPMENT |
|---|---|
| Rough mill main bearing locks and oil pan rails | Cincinnati hydraulic mill |
| Rough mill cylinder back faces and valve cover face and manifold faces | Cincinnati hydraulic mill |
| Finish mill oil pan rails | Cincinnati hydraulic mill |
| Drill (6) 13/64 in. main bearing screw holes, (1) 9/64 in. oil passage hole, (1) ⅝ in. oil pump shaft hole; drill (2) 0.7495-0.7505 location holes and drill and rough counterbore (2) oil pump stud and dowel holes | Baush adjustable spindle multiple drill |
| Drill (20) letter "G" (0.261) oil pan screw holes, counterbore (6) main bearing bolt holes, drill (2) ¼ in. oil holes from crank to cam line | Fox adjustable spindle drill press |
| Drill oil gallery hole, core drill idler hole and drill oil filler hole and chamfer holes in oil pan rail | Ingersoll 3-way deep hole drill |
| Drill, counterbore and tap angular holes in center bulkhead | Hammond radial drill |
| Counterbore core plug holes jacket face, drill two water drain holes, oil filler bracket screw hole and two oil leads from idler to support holes | Natco 4-way angular drill |
| Drill oil lead hole from rear main to cam and idler holes, ream oil filler hole and two oil pump dowel holes | Ingersoll 3-way power pack drill |
| Mill oil pump support boss and oil filter boss | Cincinnati plain hydraulic mill |
| Broach main bearing cap locks | Cincinnati hydraulic broach machine |
| Rough straddle mill center main bearing, finish straddle mill front main bearing, and inside of rear main bearing and mill notches for bearing shells | Ingersoll rise and fall mill machine |

| OPERATION | EQUIPMENT |
|---|---|
| Rough face valve clearance and rough valve throats, spot drill valve bushing holes, drill water circulation holes | Foote-Burt 2-way angular drill |
| Rough bore cylinder bores, drill valve guide bushing holes, drill 4-motor support holes, rough drill center cam bearing | Foote-Burt 2-way angular boring machine |
| Back face valve spring seats | Ingersoll — 1-way angular power pack drill |
| Drill oil pump and distributor support hole, (2) manifold dowel holes, (3) oil lead holes, (2) core plug holes | Baush special 2-way unit type drill |
| Drill (42) cylinder head bolt holes and semi-finish bore valve guide bushing holes | Foote-Burt 2-way angular drill |
| Countersink cylinder head bolt holes | Hammond radial drill press |
| Tap bottom, three sides and cylinder bank faces | Greenlee 3-way tapping machine |
| Assemble (3) main bearing caps with bolts and lockwashers | |
| Rough and semi-finish bore crank and cam bearings and idler hole rough and finish counterbore rear crank and cam bearings and face front cam bearing | Ingersoll 2-station crank and cam boring machine |
| Finish bore crank and cam bearing holes and idler hole | Ingersoll crank and cam boring machine |
| Counterbore and tap ⅜ in. pipe tap hole in oil passage | 24 in. Cincinnati drill press |
| Mill both ends to length and mill water pump joint face | Cincinnati hydraulic duplex mill |
| Profile mill valve lifter bracket bosses | Ingersoll 2-spindle vertical power pack profiler |

matically clamps after the centering plugs have entered the main bearing holes.

This machine is arranged with a back-off to the tools so they will not contact the finished surface of the bore when the table goes to rest position. This is accomplished by momentarily reversing the boring spindles and bringing all of the tools to a common horizontal location, by means of separate drive units to the boring heads.

Typical of the Natco equipment on the V-8 line are the machines used for chamfering cylinder bores, and the big four-way drilling machine. The first of these is a one-way angular machine built up of a self-contained hydraulic unit in combination with a stationary type fixture arranged to hold one block. This unit is fitted with an automatic time delay reverse and positive stop. The entire machine weighs about 10,000 pounds and will handle 35 blocks per hour. In operation, the block is loaded into the fixture and the top and bottom of four bores are chamfered in one setting. Then the block is removed, turned end for end, and the other bank of bores chamfered top and bottom.

Another of the Natco machines is the four-way hydraulic feed unit. Right and left-hand angular units contain cluster boxes with four and five spindles respectively while two rear units have single spindle boxes. The machine weighs about 24,000 pounds. The combinations of heads drills and counterbores 11 holes with a capacity of about 41 blocks per hour.

A large battery of machines made by Ingersoll, features the well-known Power Pack feed units. Perhaps the largest of these is the three-station cam and crank boring machine which has attracted much attention in motor plants. The first two stations rough and semi-finish-bore the cam and crank holes; the third station finish-bores. This unit has a rating of 30 blocks per hour.

Greenlee is another of the well-known makes represented on the V-8 line. Among these is a three-way hydraulic feed drilling machine which drills 74 holes in the block. It consists of a 43-spindle vertical head; a 23-spindle right-hand head for the front end; and an 8-spindle left-hand head for the rear.

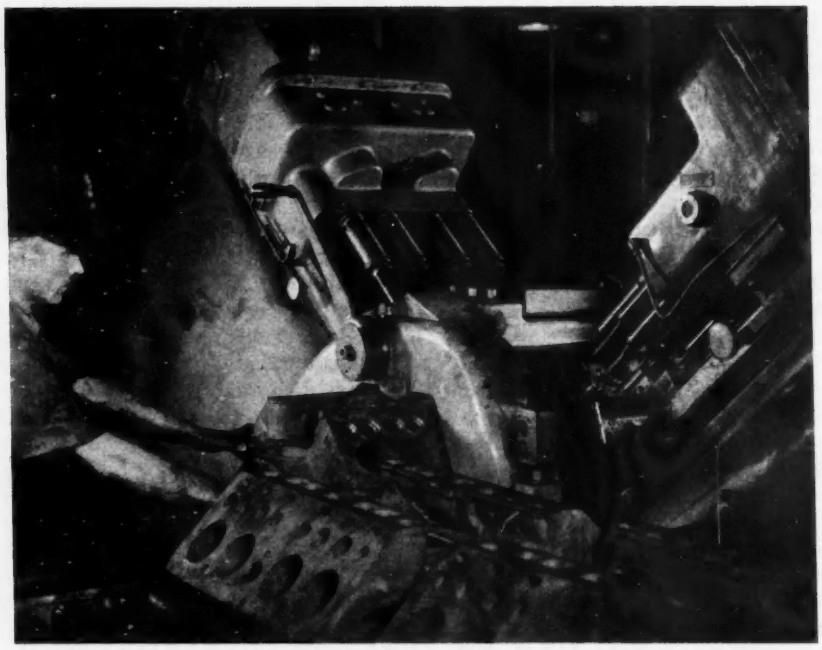
One of the outstanding features of the Cadillac motor is the finishing of valve seats. Among the operations is lapping with glass dust and then finishing by hand. This operation is checked 100 per cent for concentricity with the valve guide and for dimensional accuracy.

After finish boring each bore is checked for wall thickness by means of a magnetic gage. The object here is to assure a definite range of wall thickness since this is the determining factor in uniform cooling. A mirror-like cylinder surface finish is assured by using double honing after boring on the Heald machine.

All cylinder bores are individually gaged by a special Cadillac developed size indicating device and each bore is stamped by letters A, B, C, D, etc., indicating the standard size. The size indicating device is a special expanding gage which gives a dial reading calibrated in steps of 0.0002 inches, so as to give the correct letter grade. The

## Cylinder-Crankcase

| OPERATION | EQUIPMENT |
|---|---|
| Machine clearance slots on cylinder bank faces between intake and exhaust valve openings | Ingersoll power pack boring machine |
| Mill oil slinger and oil groove in rear main bearing. Counterbore | Cincinnati hydraulic eccentric mill |
| Drill valve bracket. Holes (2) manifold dowel holes and (12) manifold stud holes. Tap cover holes and screw and dowel holes in both ends of case | Greenlee 3-way drill |
| Tap manifold, tap cover and valve bracket holes and tap holes in both ends of case | Greenlee 3-way tapping machine |
| Wash | |
| Assemble (8) core plugs | |
| Semi-finish bore cylinder bores | Foote-Burt 2-way angular boring machine |
| Finish ream valve guide holes and counterbore and face valve throats | Foote-Burt 1-way angular boring machine |
| Chamfer cylinder bores, top and bottom | Natco 1-way angular hydraulic chamfer machine |
| Assemble valve guide bushing | Dorr - Patterson 40 - ton hydraulic press |
| Ream valve guide bushings | Detroit model "S" valve seating machine |
| Water test | |
| Ream dowel holes in front and rear ends, bore pump and distributor support hole | Baush 3-way unit type drill |
| Finish ream idler hole, oil pump and distributor support hole | Baush 2-way unit type reaming machine |
| Assemble camshaft bushings | Springfield hydraulic cam press |
| Finish mill cylinder bank, manifold and top cover faces | Cincinnati hydraulic type mill |
| Ream manifold dowel holes, drill 3/16 in. hole in top of rear housing and drill and tap oil connecting hole in center bearing | Hammond radial drill press |
| Finish bore (Tungsten Carbide) cylinder bores | Heald 1-way T.C. boring machine |
| Rough hone cylinder bores | Barnes cylinder honing machine |
| Finish hone cylinder bores | Barnes cylinder honing machine |
| Seat all valves | Detroit model "B" valve seating machine |
| Hand seat and grind valve seat | |
| Lap all valve seats | Detroit model "C" valve lapping machine |
| Finish line ream cam bearings and ream rear main bearing. Counterbore | |
| Assemble clutch housing to crankcase with dowels and screws—assemble idler gear support | |
| Machine transmission joint face and pilot diameter of clutch housing to finish thrust faces of center main bearing | Ingersoll power pack boring and facing machine |



**(Left) Rough-bore valve throats and drill water circulation holes on this two-way Foote-Burt angular drilling machine. It takes two settings of the block to complete the operation in this machine**

dimension is further broken down by sizes of plus and minus for each letter giving a grade as low as a dimension of 0.00006 in.

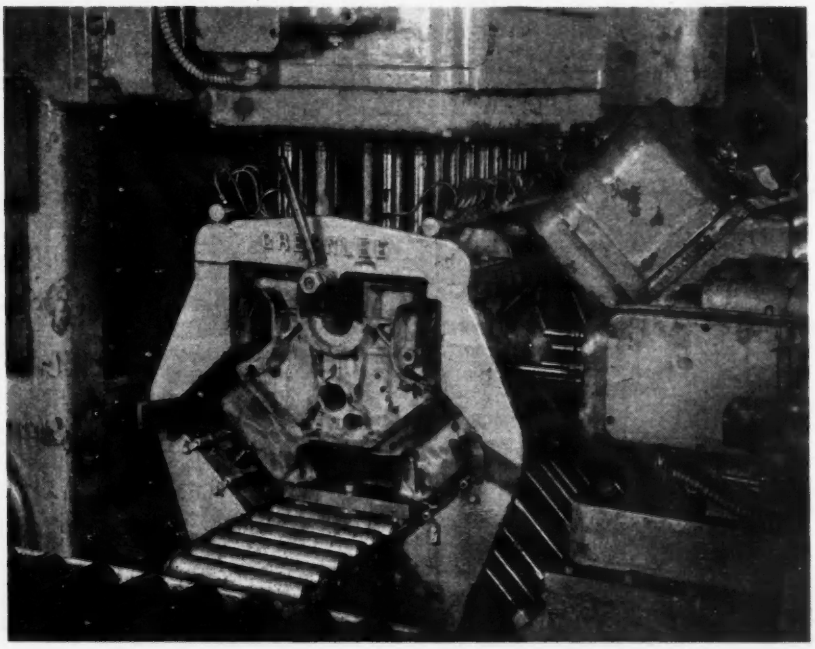
Pistons are graded in similar fashion so that the set of pistons selected for each block corresponds to the letter notation stamped on each cylinder.

Blocks are water-tested using a special stationary fixture which is submerged in water by hoisting the tank up to the fixture. With the tank in place, air pressure is applied so as to produce a more severe condition than is ever encountered in service.

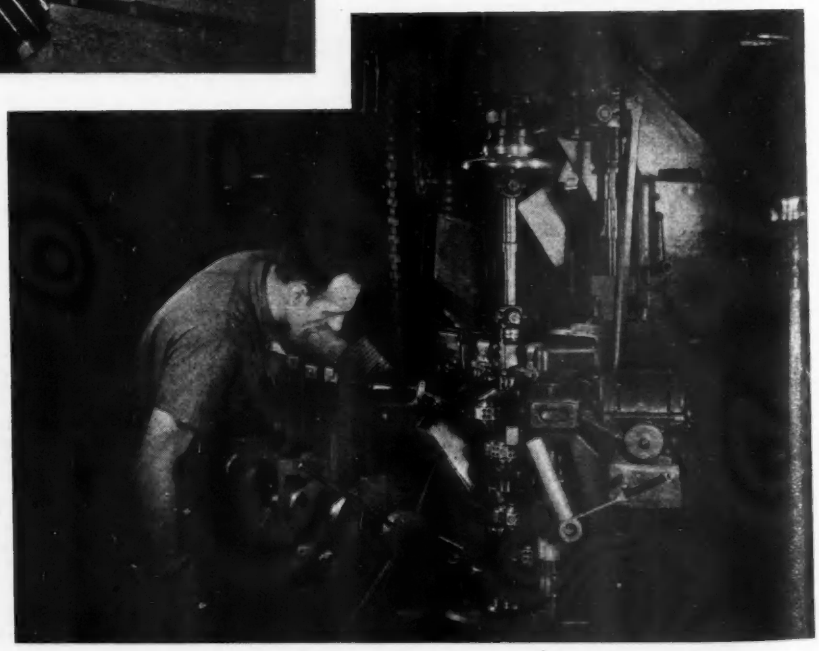
It is important to note that Cadillac balances the complete assembly of crankshaft, clutch, and flywheel within a limit of ½-ounce in.

On camshaft machining perhaps the most outstanding feature and one which is not found elsewhere, is the use of the Norton Camolap. This is the first application of an automatic lapping machine for simultaneously finishing camshaft journals and cams.

Most readers of AUTOMOTIVE INDUSTRIES are familiar with the design of the new Cadillac connecting rod. This is a scientifically proportioned forging, very light due to economical distribution of sections, and split diagonally at the bearing joint face so as to



**(Above) This Greenlee automatic tapping machine with multiple heads is used to tap all holes in bottom, three sides, and on cylinder bank faces of V-8 blocks**



**(Right) V-8 crankshaft is balanced on this GMR dynamic balancing machine**

(Left) Greatest care is exercised in the foundry to assure the perfection of V-block castings. In this view we see the separate core pieces being assembled in a special steel fixture which assures accurate alignment of entire group

(Center) Hardness of connecting rod forgings is tested before machining on a direct reading Gogan Rockwell hardness machine

permit withdrawal through the cylinder bores.

Although the complete routing of the rod will be found elsewhere in the article, we wish to draw your attention to several rather outstanding operations. One of these—the drilling and reaming of the big end and sawing off of the cap—is performed in one setting on a four-station, center column, Greenlee hydraulic indexing machine.

This is a vertical machine with three self-contained hydraulic feed units mounted on the column—one has a 4-spindle drilling and boring head; the second carries a 4-spindle reaming and drilling head; while the third is fitted with a milling head carrying three slitting saws. Each fixture is arranged to hold two rods.

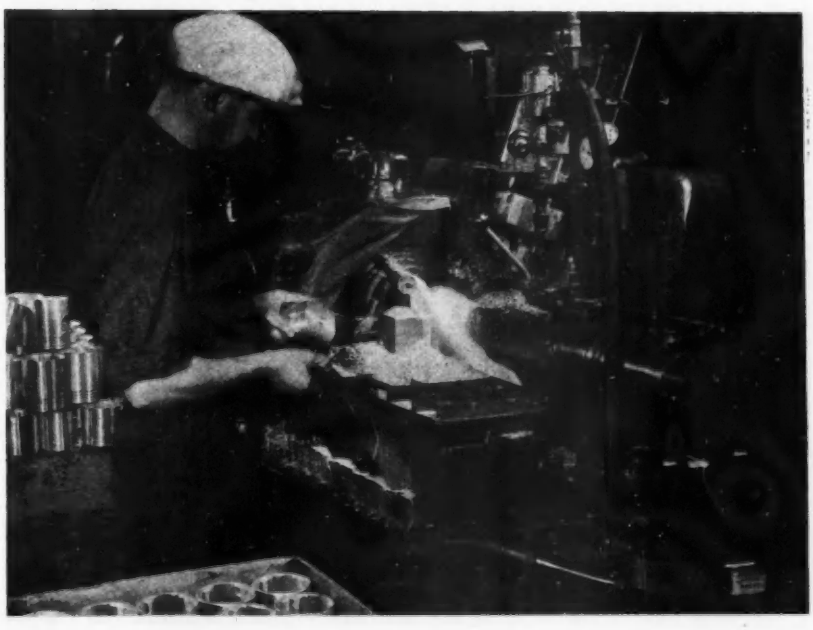
A 15-ton Colonial broaching machine is used to broach the joint face of the rod.

## Motor Assembly

Without going into the detail of motor assembly operations, we wish to emphasize some general principles that characterize the building of Cadillac engines.

In the first place, all engine parts—piston and rod assemblies, crankshaft, bearings, etc., are thoroughly lubricated with a special break-in oil before assembly. Not only does this safeguard the engine on its initial block test but it carries protection to the initial service period of the car's operation. This precaution coupled with the special procedure on block test has made it possible to eliminate the usual practice of tearing engines down after block test for final inspection.

(Below) Sundstrand automatic lathe is used for grooving the aluminum alloy pistons

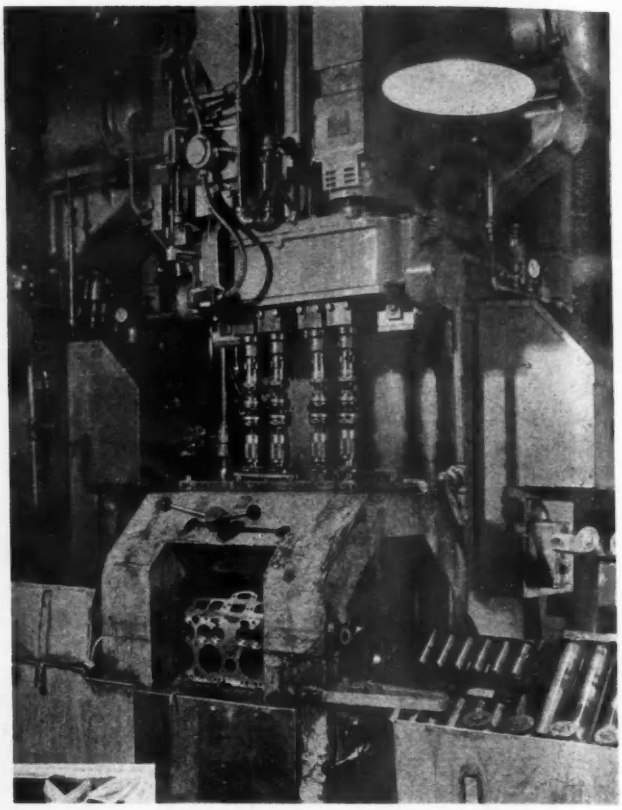


On block test all engines are run on gasoline and with an oil pressure setting higher than normal to check on the performance of the hydraulic valve lifters. The circulated oil is a special break-in material which is fed from a system of storage tanks. This oil is constantly circulated at a pressure of 55 lbs. and preheated to 160 deg. F. before entering the engine oil lines.

In operation the break-in oil is fed to the block test and the oil return is constantly led to tanks in the basement, by gravity. From here the oil is pumped through a battery of centrifuges which remove all foreign material. Filtered oil then goes to the storage tanks.

Block testing is a 100 per cent operation and is carried on under definitely controlled conditions. First the engine elements are brought up to standard temperature by connecting up the lubricating oil line which is preheated to 160 deg. F.; then the circulating water, held thermostatically at 155 deg. F. is turned on. Following these preliminaries, the engine is "motored" by the dynamometer for about five minutes at 1000 r.p.m. Then the fuel line is attached and the engine started under power.

V-12 and V-16 engines have a special test line and are accorded special treatment.



**Cylinder bores are finish-honed on this Barnes machine fitted with Micromatic hones with Quicklock drivers. Feature of the machine is a tilting turntable which permits honing one bank at a time and then indexing second bank into position**

## Factory Routing for Rear Axle Carrier Differential

| OPERATION | EQUIPMENT |
|---|---|
| Rough and finish turn main flange | Bullard vertical turret lathe |
| Drill 12 and ream 2 holes in main flange | Natco multi-spindle drill press |
| Semi-finish two bearing diameters and oil seal diameter, finish sleeve diameter and semi-finish bearing shoulder | No. 16 Foote-Burt hydraulic drill press |
| Hollow mill and face oil guard diameter on pinion bore | No. 217 Baker drill press |
| Drill, chamfer, surface and tap 3-½-20 amer. holes | 24 in. Cincinnati drill press |
| Mill 3⅞ in. diameter inside differential bosses | No. 3 Sundstrand rigidmill |
| Rough bore, ream and chamfer differential bores, surface shim surface | Natco 2-way boring machine |
| Drill two lockscrew holes and two ¼ in. oil holes and chamfer two ¼ in. holes | No. 13 Natco multi-drill press |
| Finish boring bearing diameters and oil seal diameter and differential bores and face bearing shoulder in pinion bore | Heald SpecTriway borematic |
| Saw and straddle mill lock screw bosses | Sundstrand rigidmill |
| Wash | |
| Final inspection — Expand support boss on gear side 0.005, mark dimension from shim surface to pinion bore on case, check dimension between support bosses and mark on case | |

### Rear Axle

For some years Cadillac rear axle production has been characterized by unique procedures. For one thing, it is a practice here to base the machining and assembly of differential carriers upon the alignment of matched gear sets. That is to say, the whole axle assembly is based upon the most favorable alignment of ring gear and pinion so as to take advantage of ideal gear tooth contact.

Because of this, the gear matching heads are mounted on special indexing tables which permit an accurate record of the best alignment—above or below center and at special inclination of the axes. These data are recorded according to a system of special symbols which completely specify the alignment of each gear set. These data, in turn, are used in determining the most suitable carrier conditions as well as alignment at final assembly.

Since contact area is the determining element, the final inspection looks for this feature. Special test rooms are found in the axle department to provide facilities for matching and finally for running-in the carrier assemblies.

In the case of the latter, the gear set is tested under load for forward, reverse, and coasting conditions. The latter condition is not a matter of ordinary practice and at Cadillac, the coasting effect is achieved by a special flywheel drive through the ring gear instead of the customary drive through the pinion.

For 1937, LaSalle and the Cadillac 60 Series use the hypoid rear axle. Hypoid gear sets are produced on the now familiar Gleason machines using a non-generating principle which greatly speeds up productivity. A new Cimatool chamfering machine was developed recently for hypoid gears and is being used in this department.

A novelty worth special mention in connection with machining the differential carrier is a No. 43 Heald Bore-Matic, a Tri-Way precision boring machine for simultaneously boring the cross holes and the pinion hole. The base has three radial legs, each of which carries a hydraulic precision boring unit mounted in angular relation to each other. The three units each carry a boring head and have individual hydraulic feed with the travel of all three synchronized for both feed and reversal from a single master stop and start control box.

Simultaneous tri-way boring of three holes in this manner not only results in remarkably close tolerances for angular spacing alignment, size, roundness and straightness, but in addition, assures increased production, at a reduced cost.

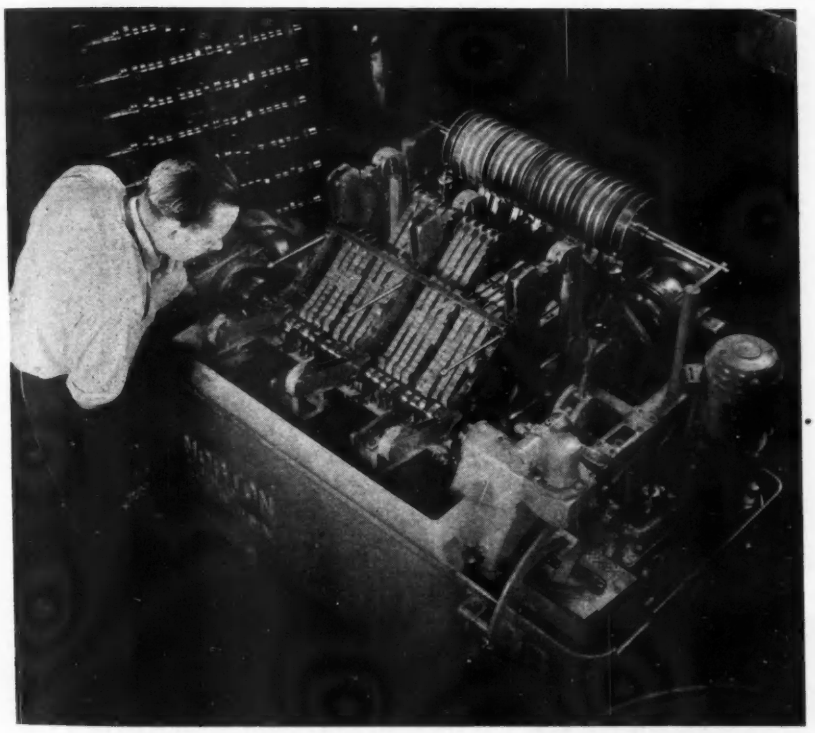
## Transmission Department

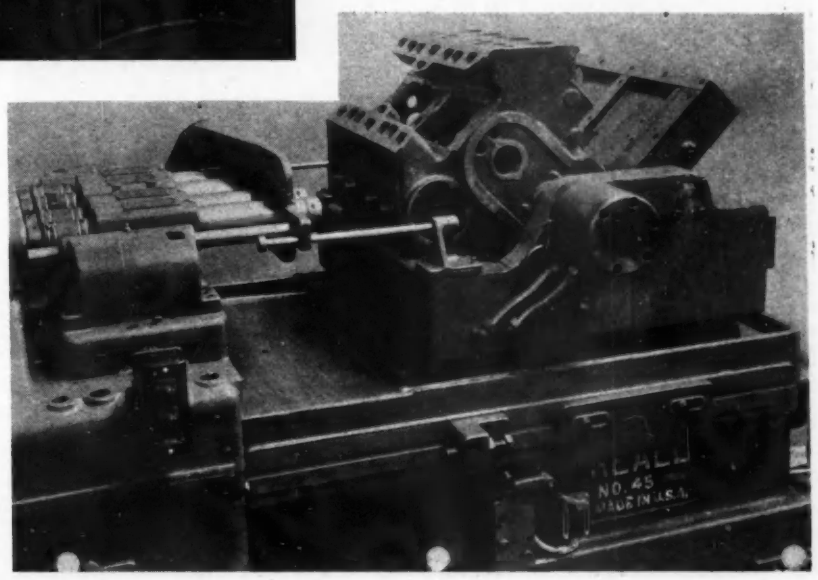
As mentioned earlier, one transmission is used for the entire line up to the V-16. This has permitted Cadillac to centralize its manufacturing operations within an economical compass, and to utilize the most modern production equipment.

Probably nothing is of greater interest than the fact that the finish-grinding of transmission gears has been entirely eliminated. Several years ago this would have been considered but a wild dream; today it's a reality by virtue of the progress that has been made in transmission gear production techniques. There is no place here for a detailed discussion of the controls that enter into the picture—the accurate control of steel analysis and grain size, forging control, control of gear cutting procedures, and heat treatment. However, one of the basic changes is the introduction of gear shaving as exemplified by the battery of five new Michigan shavers which are used to correct the gear form of all gears processed in this department.

Suffice it to say that gear shaving has entirely eliminated gear grinding and has even reduced the amount of gear lapping after heat treatment.

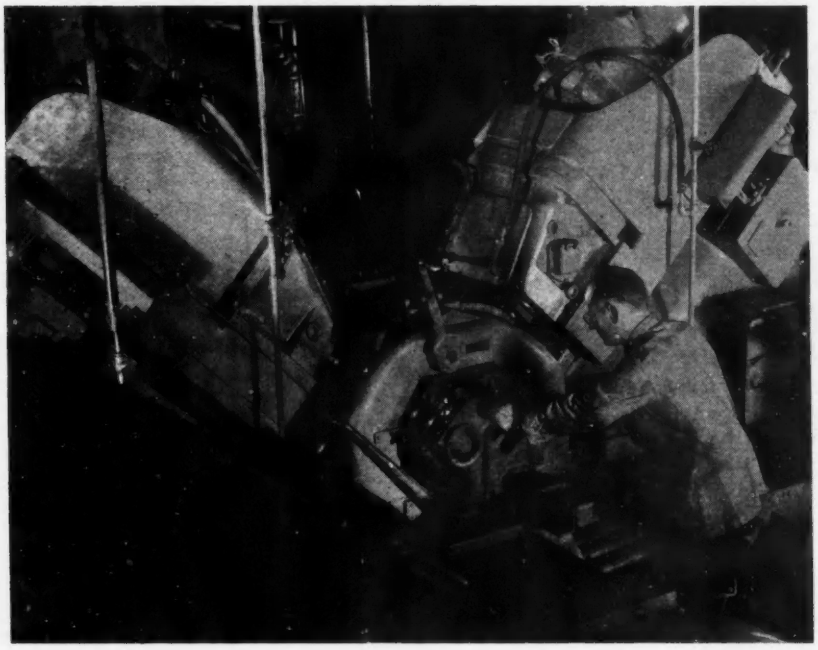
The department is laid out in a very interesting fashion. An entire bay at one end houses the various equipment for preliminary operations—such as lathes, broaches, gear shapers, gear hobbers, etc. As the various gears complete their course through the preparatory stages, they are routed to the battery of Michigan shavers. Having received the corrective treatment of tooth profile and spacing, the gears are transported to the heat treating department. The routing of the counter-






**(Above) Probably first installation of its kind is the Noroton Camolap which automatically polishes bearings and cams on V-8 camshafts**

**(Right) Close-up of No. 45 Heald precision boring machine which is used for finish-boring cylinder bores. The machine is equipped with a tilting table which brings each bank of four cylinders into a perfectly horizontal position for boring. Single-point, tungsten-carbide tools are used**



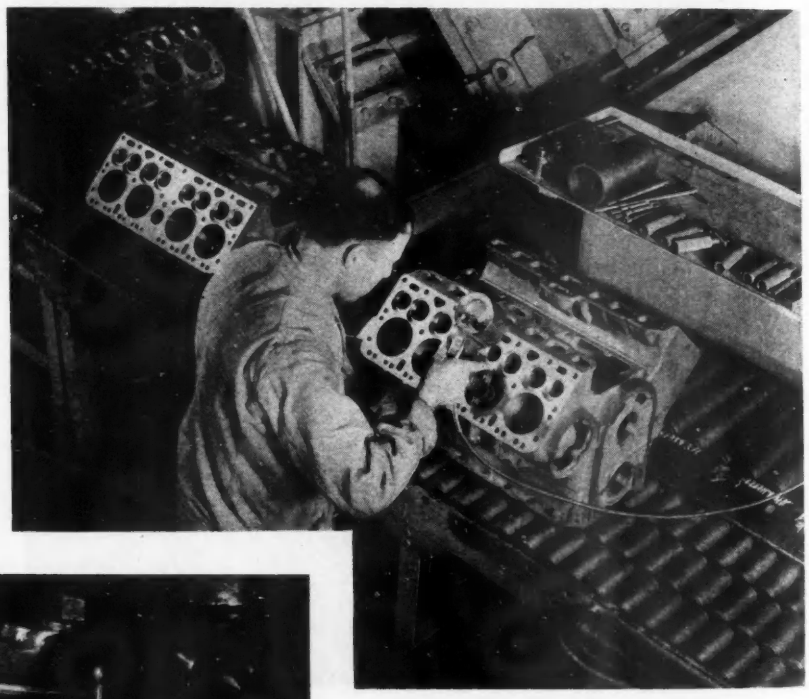
Foote-Burt two-way angular drilling machine is used to rough-bore cylinder bores; drill valve guide bushing holes, etc. This operation takes two settings in the machine since the boring heads take only one bank of cylinders at a time

gear may be taken as a typical example of the entire process.

As we proceed down the length of the department, we find that the center section is devoted to the manufacture of transmission cases and miscellaneous small parts which feed to the assembly line, extending from the lower half of the center section to the end of the third bay of the department.

After heat treatment, the gears are transported to the third bay at the extreme end section which is set up as a grinding department for face-grinding, bore grinding, polishing, etc., of gear blank surfaces—however, not for any gear tooth grinding operations. Following this the gears enter the first phase of assembly—gear testing, matching, lapping, etc.

In matching, Cadillac has a number of inspection booths for various operations. Gears are matched in pairs, first, one machine for each pair; then matched in sets on other machines. All gears are given a lapping treatment on Inco laps. The complete matched sets are kept together and mounted in



(Above) Cylinder wall thickness is carefully checked by means of the magnetic gage shown here. Uniformity of wall thickness within narrow limits is rigidly demanded due to the influence of this element upon the cooling characteristics of the engine

(Left) Finish-grinding of transmission gears has been entirely eliminated by the adoption of gear shaving before heat treatment. Here is a close-up of one of a battery of Michigan Tool gear shaving machines used to correct transmission gear teeth after gear cutting

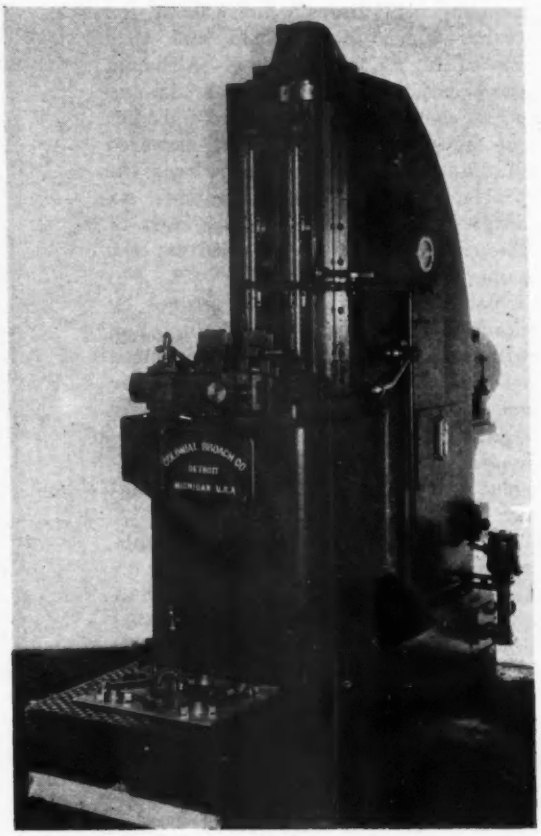
trays which carry them to the assembly station.

When the units have been completely assembled in cases, each transmission is filled with lubricant at a station fitted with an automatic gun and then proceeds to the final run-in and inspection. This is a 100 per cent operation.

### Press Shop

The press shop is quite conventional both in equipment and procedures, one of the recent developments being the stamping of the huge front fenders in two sections and flash-welding into one unit on a Federal welder. Another new item of equipment is the Cincinnati shear which is equipped with electric holddowns and a built-in sizing device, the combination being most effective in producing accurate work at greatly increased productivity. This shear has a capacity of 3/16 in. in mild steel.

However, there is a novelty here in the way they handle sheet metal for the custom-built V-16 cars. Production volume is so small that it is not economical to make up press dies or store sheet metal stock. Instead, the V-16 chassis complete with body and radiator shell is taken directly off the assembly line and transported to the sheet metal department. Skilled sheet metal workers then tailor-fit each car with fenders, splashers, radiator shell and grille—all of these parts being made up by hand. The sheet metal then is routed along with other parts to Bonderize and paint, carefully identified as to the chassis, and installed later.



**15-ton Colonial vertical hydraulic broaching machine is set up to broach the joint face of rod and cap. Machine has 36 in. stroke.**

## Factory Routing for Connecting Rod

| OPERATION | EQUIPMENT |
|---|---|
| Heat treat, quench and temper | |
| Tumble | Wheelabrator |
| Brinell test and straighten | Bench |
| Inspect | Gogan auto. Brinell test |
| Grind crank pin end to 1.162-1.166 wide | No. 14 Gardner double spindle grinder |
| Straddle mill wrist pin end to width | Sundstrand rigidmill |
| Profile drill crank hole to 2½ in. diameter, drill and ream wrist pin hole to 0.915-0.917 diameter, mill 4.467-4.470 dimension, to 4½ in., saw apart | Greenlee center column machine |
| Burr wrist pin hole both sides | 21 in. Cincinnati drill press |
| Hollow mill wrist pin boss | 24 in. Cincinnati drill press |
| Profile mill wrist pin boss | No. 1-A Milwaukee vertical mill. machine |
| Broach joint face of rod and locating surface (4.467-4.470 dimension); broach locating surfaces on cap | Colonial 15-ton vertical broach machine |
| Drill, chamfer and ream bolt holes in rod, drill, ream and chamfer bolt holes in cap; hollow mill dowels, surface bolt holes in cap and chamfer | Greenlee multiple spdindle center column machine |
| Mill bearing anchor slots in rod and cap | No. 6 Whitney hand miller |
| Burr counter bore in cap | Hisey-Wolf grinder |
| Tap two bolt holes in rod | Baush horizontal tapping machine |
| Gun drill hole (7/32 in. diameter) in rod | Krueger gun drilling machine |
| Drill split holes in rod | No. 4 Kingsbury 4-spindle drill press |

### Assembly Building

This department handles all the final details of car assembly. It houses complete facilities for finishing sheet metal, chassis assembly, final assembly, repair lines, and all inspection operations.

Assuming that all preparatory and final paint operations have been concluded, the entire operation on the assembly floor starts with the body receiving station. Thus the body is the starting point for the telautograph scheduling of all activity. Bodies are prepared on the wiring line where they are fitted with wiring, instrument panels, and various equipment and accessories. Then they are fitted with rear fenders and are ready for the body drop to the assembly floor.

On the main floor, the preliminary

assembly operations center about the frame which is inspected and then routed to the chassis line. Although the chassis conveyor may look like any other conveyor, in reality it embodies the product of some high-powered planning and thinking. Here was the problem—the 1937 line includes six different chassis lengths and each of the chasses must be handled on the same line. How to do it?

You will find the simple answer by examining the conveyor chain. You will note immediately that it is fitted with a special carrier, for the rear end of the chassis, consisting of six separate brackets, one for each chassis length. A somewhat similiar arrangement was applied on the final assembly line.

Following the usual practice, subassembly stations and lines feed directly to the main chassis assembly at points of usage. At one station we find a new GMR propeller shaft balancing machine, the first of its kind. This machine is capable of a rotative speed of 5000 r.p.m., and will give readings of balance within 1/16 ounce in. An important development revealed in this machine is the use of a single shrouded station at one end of the machine for noting balance; the balance of each end is obtained selectively by pressing a control button.

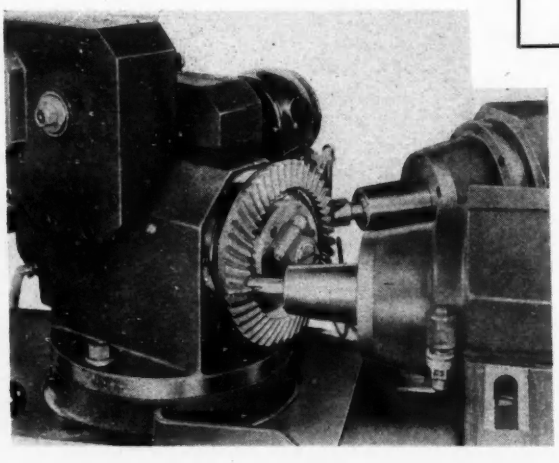
At the terminal end of the chassis assembly line, the chassis is turned over, right side up and carried by a hoist to the final line. The final line is distinguished by many fine touches. Here for example is the conveyor chain fitted with a series of cradles, each one comprising six notches, one for each of the six different wheelbases, and individual sets of wheels for supporting each connection. To facilitate assembly operations, the line is provided with the Bull-Dog power duct for distributing power to the Hicycle portable tools, the latter being mounted on Thor balancers to further aid the operators.

Front end sheet metal is assembled as a complete unit on a series of framing bucks and is then delivered to assembly line for installation. All cars go over the same final assembly line.

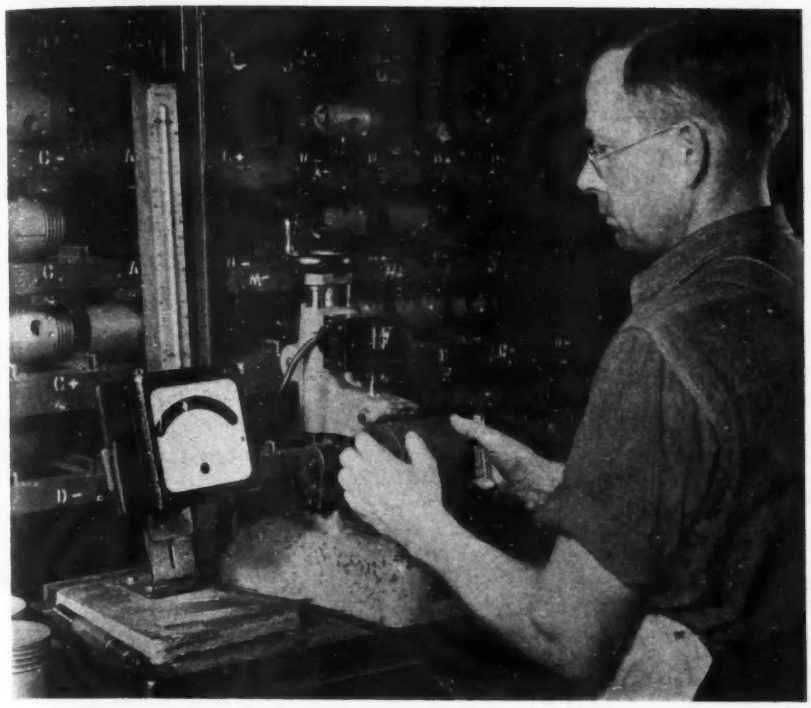
Upon leaving the assemby line the nature of the final inspection and handling depends upon the car model. For example, the LaSalle and Cadillac 60 proceed directly to the chassis rolls

## Factory Routing for Counter Gear

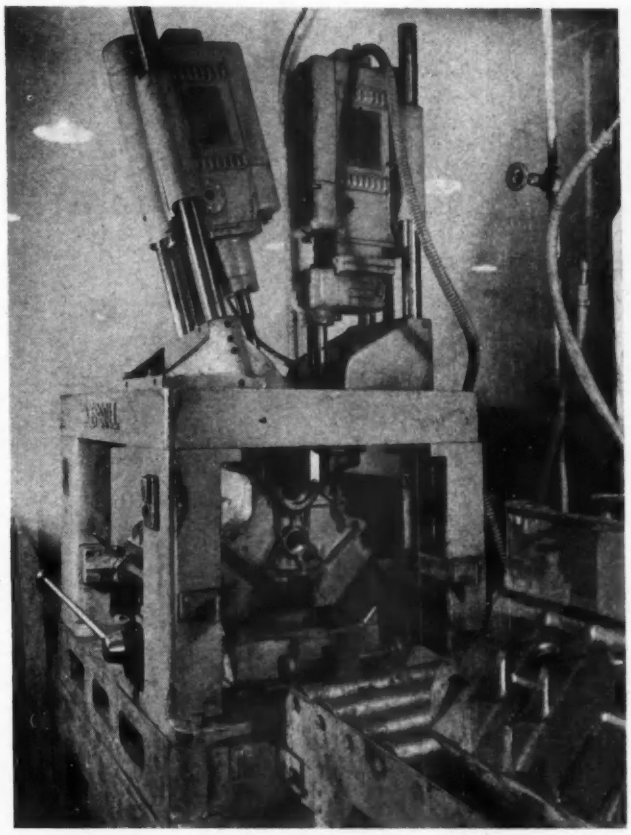
| OPERATION | EQUIPMENT |
|---|---|
| Normalize | Furnace |
| Tumble | Wheelabrator |
| Inspect | |
| Drill 1 3/64 in. diameter hole through | Snyder two-way drill |
| Drill, counterbore, ream, center and cut relief—both ends | Sundstrand double end boring machine |
| Turn and face large gear end complete | 14 in. Fay automatic lathe |
| Turn and face small gear end complete | 14 in. Fay automatic lathe |
| Rough cut teeth on 16-tooth gear | No. 75-A Fellows gear shaper |
| Finish cut teeth on 16-tooth gear | No. 75-A Fellows gear shaper |
| Hob large gear teeth | Barber-Colman hobbing machine model "A" |
| Hob teeth on 2nd speed gear | Model "A" Barber-Colman hobbing machine |
| Drill ¼ in. hole for driving and drill and ream 0.374 hole | No. 2 Leland-Gifford hand feed 3-spindle drill |
| Chamfer teeth on 2nd speed gear | Cross tooth rounder |
| Chamfer teeth on large gear | Cross gear tooth rounder |
| Chamfer teeth on 2nd speed gear on ang. side | Cross gear tooth rounder |
| Chamfer teeth on large gear (ang. side) | Cross tooth rounder |
| Round teeth on low and reverse gear | No. 3 Peerless chamfer machine |
| Chamfer low and reverse gear teeth at recess | Cross tooth rounder |
| Burr complete | |
| Lap centers and shave 16 tooth gear | Motor—Michigan Tool Co. shaving machine |
| Shave 17-tooth gear | Michigan Tool Co. shaving machine |
| Shave 21-tooth gear | Michigan Tool Co. shaving machine |
| Wash | |
| Heat treat | |
| Pickle | Bullard-Dunn process |
| Inspect | |
| Clean centers | |



**New type Cimatool chamfering machine was developed for chamfering hypoid ring gear teeth. Outside and inside tooth surfaces chamfered simultaneously as shown**



(Left) Sensitive electric gaging machine is used for sorting pistons for selective fitting in the block. The method is so precise that 30 grades are represented in a tolerance of 0.0002 in. The instrument is constantly corrected for standard temperature, using the thermometer directly behind the gage dial



(Right) Unit-type three-way Ingersoll Power Pack drilling unit—drills oil lead hole from rear main to cam and idler, reams oil filler hole and two oil pump dowel holes

for initial break-in, have front wheel alignment adjusted on the new Bean inspection machine, and then are driven to the car repair line.

Big cars, on the other hand, are given a road test first, and then move over to the repair lines. The custom-built V-16 cars come off the line without sheet metal—as was described in the section on the "Press Shop"—and undergo a 100-mile road test.

Because of the unusual care with which the Cadillac cars are inspected for even the most minute imperfection, the final repair lines occupy a very appreciable portion of the floor space in the assembly building. In addition to the regular inspection and repair lines, there are separate areas set aside for major repairs and adjustments wherever these would tend to retard the work on the main lines.

After the cars have run the hurdle of all preliminary repairs and inspection, they enter the final inspection line. Here the windshield is subjected to a water spray to assure freedom from leaks; and the paint is given its final inspection. This department is provided with its own drying oven for setting touch-up paint repairs. Paint inspection is made with the aid of the high-intensity mercury vapor lamps. An interesting point in this connection, and one that bears witness to the degree of technical achievement at every step, is the fact that they have found it desirable to paint a rectangular floor area adjacent to the inspection line—in white—as this tends to reflect most of the light available and thus aids in producing the most favorable seeing conditions. This white area is swept clean regularly and is repainted whenever necessary.

The final touch in the assembly department is the recent installation of exhaust ducts, honeycombing the entire ceiling area at points where cars are first driven off under power. This is a big step in producing worker comfort.

# Knee Action Assembly on the Pontiac

1

**(Above)—One end of the knee action springs are fastened into their pockets at either end of the heavy front cross member of the chassis frame**

2

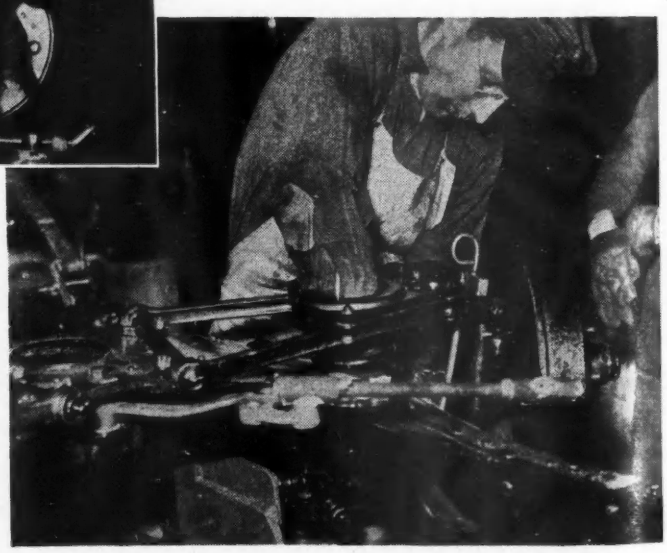
**(Circle) — Knee action linkage and front wheel brake drums are installed and secured in place by means of electric power wrenches**

3

**Closeup of the operation of securing the knee action linkage mechanism to the chassis frame by means of electric power wrenches**

5

**(Below) — Assembling the knee action springs and linkage to the Pontiac chassis frame**

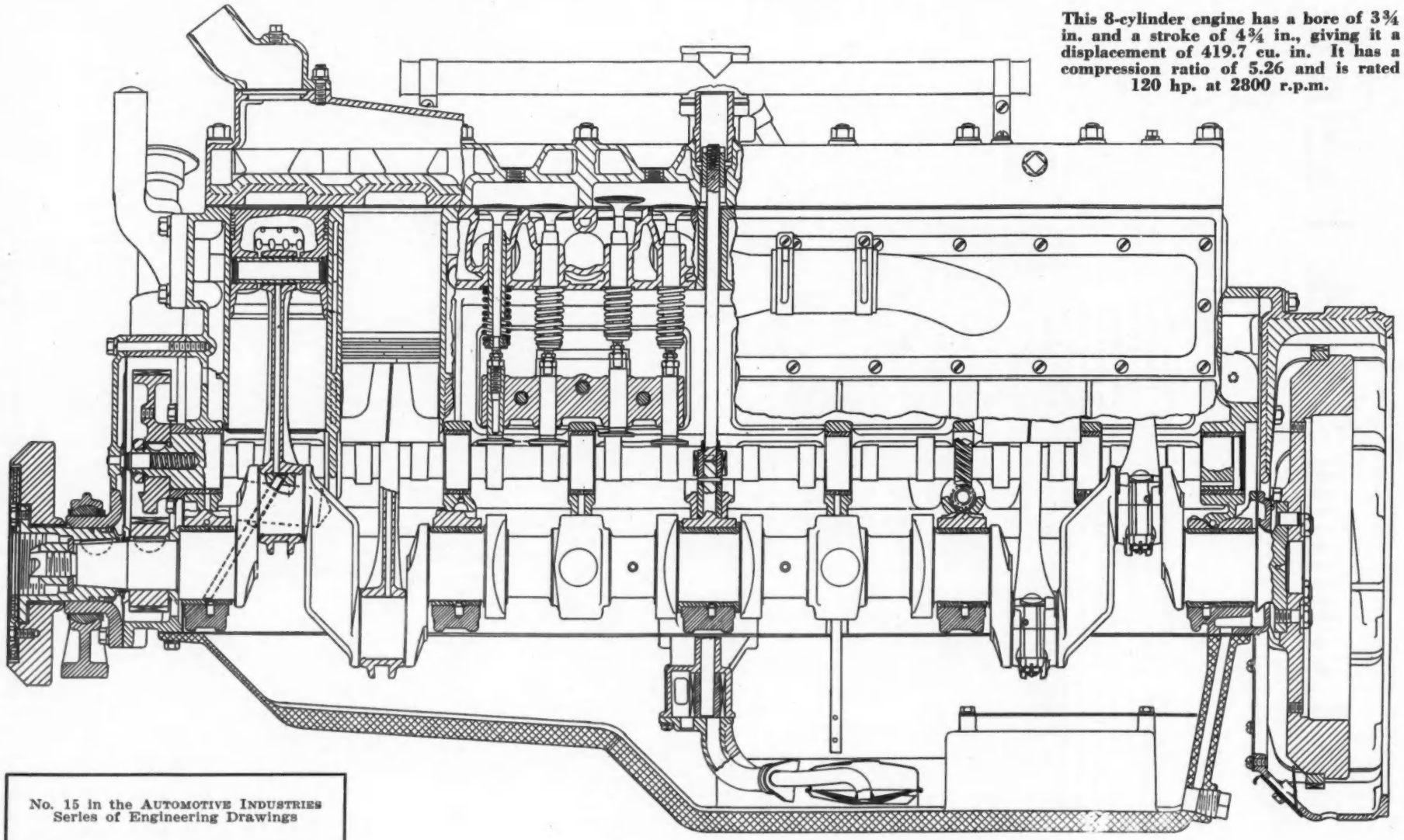


4

**(Left) — Pneumatic jack compresses knee action mechanism into position after parts have been fastened to each other and to chassis frame**

# Lycoming Truck Engine, Model AEF

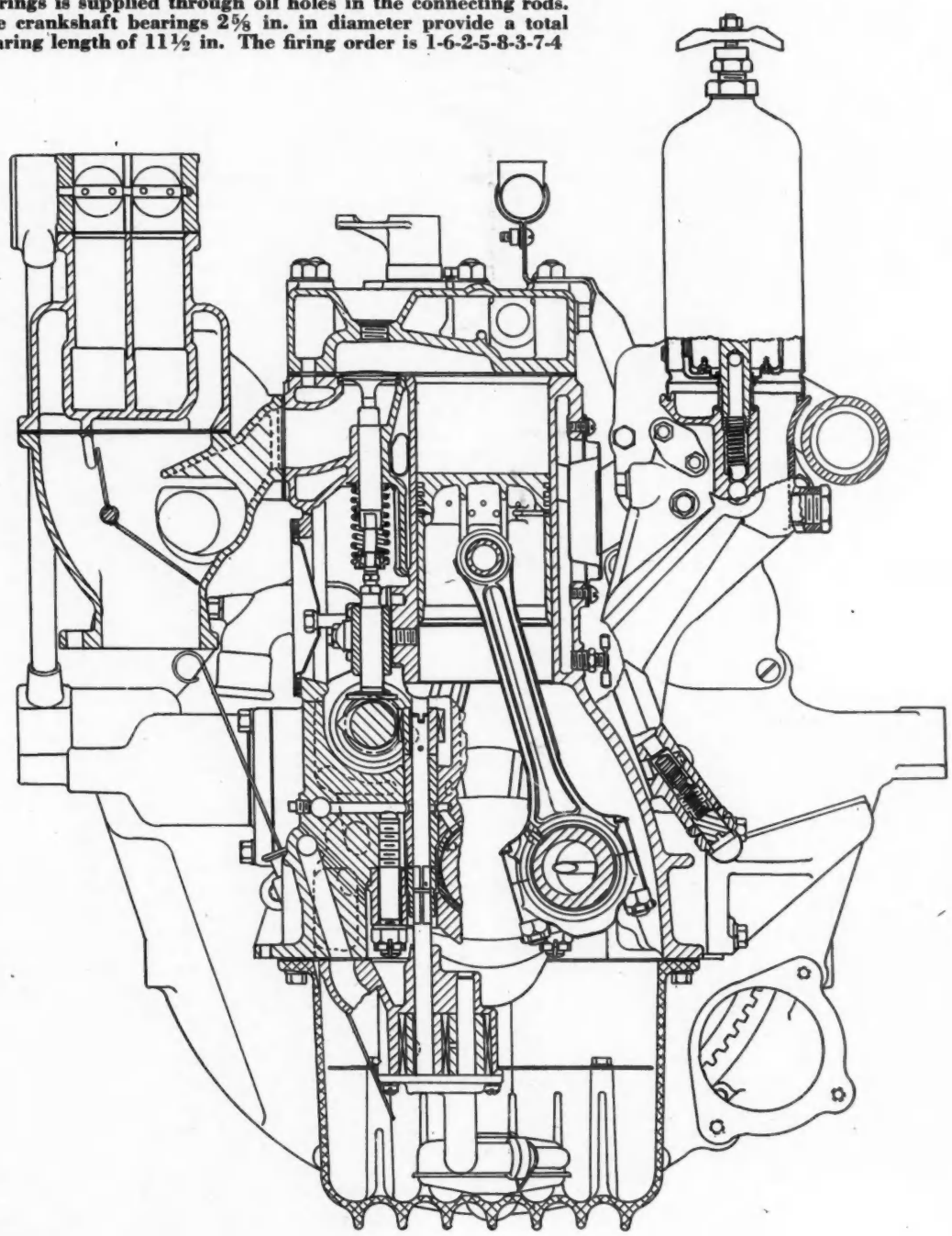
**This 8-cylinder engine has a bore of 3¾ in. and a stroke of 4¾ in., giving it a displacement of 419.7 cu. in. It has a compression ratio of 5.26 and is rated 120 hp. at 2800 r.p.m.**



No. 15 in the AUTOMOTIVE INDUSTRIES Series of Engineering Drawings

# Lycoming Truck Engine

**Transverse view of a Lycoming model AEF truck engine. The aluminum alloy pistons carry four rings each. Connecting rods are 9 in. in length center to center and weigh 3.4 lb. each. The connecting rod bearings are 2 11/32 in. in diameter and 1 11/16 in. long. Pressure lubrication of the piston pin bearings is supplied through oil holes in the connecting rods. Five crankshaft bearings 2⅝ in. in diameter provide a total bearing length of 11½ in. The firing order is 1-6-2-5-8-3-7-4**



## How Sitdown Strikes Began

(*Continued from page 381*)

the time the Firestone strike ended, Goodyear pit workers struck in protest against a 10 per cent wage cut. "Fifteen minutes to return to work, or clear out," was the ultimatum of a Goodyear official, and the second sitdown strike ended immediately.

The significance and potentialities of the sitdown method generally passed unnoticed at the time. The press scarcely knew what to call the movement, and shied at using the word "strike," since the men were still in the plant. They referred to the situation as an "interruption of work," with the employes "sitting at their machines." In its report of the Firestone strike in the Feb. 1, 1936, issue, AUTOMOTIVE INDUSTRIES coined the word "sit-down"—a word which has since made its place in the American language and is no longer used with hyphen and quotation marks.

The following week, after the sitdowns had been settled, it was stated in AUTOMOTIVE INDUSTRIES: "The strikes were unique and without precedent in the history of the tire industry. In neither instance did the employes walk out. Instead, they remained at their posts, reading newspapers, chatting in groups and playing on improvised checkerboards, using pop bottle caps as checker men." The men were brought food and blankets by their families and friends, exchange of articles and messages taking place through windows of the plant. Not much improvement in sitdown technique has been made since then.

At a time when labor leaders are defending the sitdown method, and even a member of the President's cabinet has said, "the legality of the sitdown strike has yet to be determined," it is interesting to note that but little more than a year ago the head of the rubber workers' union condemned such action. When a sitdown strike in a Goodrich plant followed closely on the heels of the Firestone and Goodyear disputes, S. H. Dalrymple, national president of the United Rubber Workers of America, approved action of the Goodrich management in refusing to pay employes who had remained idle at their posts for several shifts, and said:

"It is my opinion that compensation being paid by industry to employes in the way of strike benefits is detrimental both to industry and to our own United Rubber Workers. It would have the tendency to induce workers to sit down or to strike to such an extent that it would keep the local union and the management in confusion."

Speaking at a mass meeting of more than 1000 rubber workers held in Akron on Sunday, Feb. 9, 1936, Mr. Dalrymple is reported to have said, commenting on the new sitdown method of striking: "Such cessation of work does not demonstrate efficiency. On the other hand it does demonstrate a dual movement. The proper way to handle grievances is through your union officers when a controversy with management arises. All possible means of a peaceful settlement should be used. If all other efforts fail, there is still time to strike."

But restless and irresponsible workers had realized the possibilities of the sitdown. A small, determined minority could close the greatest plants. A few hot-headed members of a local could start a movement without the approval of national union officials. Akron workers adopted enthusiastically the sitdown. After the first abortive move, Goodyear was badly hit with a sitdown that started in February, 1936, and lasted for six weeks.

Realizing the seriousness of the threat to their community, Akron citizens organized. Injunctions were issued and posted; the strikers tore them down. Citizens talked of forming a "human wedge" of 10,000 which would march into the plant. Strikers armed themselves with pieces of metal from used car lots, pins were taken from bowling alleys, and a solid line of 6000

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strikers blocked the street leading to the Goodyear factory. Violence seemed imminent when the Akron *Beacon Journal* condemned the "human wedge" plan and rebuked its organizers. The crisis passed and the strike was settled a little later.

But that strike was only the first of more than 50 sitdowns in the Goodyear plants alone. The other tire companies had their share, too. Sometimes but a small group of men were involved, sometimes thousands. Late in February some 30 Goodyear foremen were herded into an improvised "prison" and kept hostage for a whole day. Goodyear employes in Plant No. 1 were told that men in Plant No. 2 were "sitting down," and promptly struck. Plant No. 2 then stopped because Plant No. 1 was striking. At one time over 15,000 Goodyear men were out of work.

Then the Akron sitdowns became world news. In March, when the series of strikes was finally settled, not only the U. S. press but that of other industrial nations were carrying long stories of the new sitdown method of striking. And it is doubtless from these dispatches that French workers learned all about sitdowns and two months later staged their series of "bras croisés" strikes.

Akron industries finally solved their problem by a vast program of decentralization that threatened to take all possibility of employment away from irresponsible union members. In Santa Monica, Calif., a few determined law enforcement officials quietly arrested workmen who had seized the Douglas airplane factory. Perhaps the future will develop other effective means of combatting the dangerous sitdown movement.

# Letters

## to AUTOMOTIVE INDUSTRIES

*Beginning with last week's issue, "Letters" is a regular weekly feature of* AUTOMOTIVE INDUSTRIES, *replacing the sporadic appearance of "The Forum."*

### Automatic Gear Shifts

It appears that the reason automatic gear shifts make such slow progress is because the devices have so many fine-adjusted air valves and electrical connections that cause trouble. This can be avoided by using a single vacuum cylinder operated by a D slide valve.

The piston rod is connected to a lever that moves two plungers in the gearcase cover, to neutral and back to operative positions. The plungers push the gears to neutral, and one of four dogs pivoted on the plungers engages and pulls into mesh any gear that is selected by moving a small control lever, on the steering wheel post, which moves the selector-strip, in the gear case cover, when the plungers are in either operative or neutral positions.

Burton A. Walrath.

*Our correspondent's argument regarding the reason for the slow progress of automatic gear shifts does not convince us. Numerous automatic gear shifts have been invented which have no electrical parts and others which have no air valves, but the only one in practical use today has these elements.*

### Diesel Economy

Recently the New York press reported aeronautic engineers as stating that the spark-ignited engine will shortly be outstripping the Diesel engine in economy of fuel.

About 10 years ago I objected in your columns to applying the highly significant and valuable name of Diesel to engines that simply couldn't be made to break away from operation on the Otto cycle, urging the substitution of some abbreviation to signify the condition of compression ignited, an old Malay method of starting combustion.

But not only did the banker minded, with an eye to sales, have their way, but it was made unpleasant for anyone to hold out for the possibility of vaporization occurring before ignition in compression-ignited engines, something not then proved but later verified by research findings at the Langley Memorial Laboratory. The writer even received a written request, not too graciously worded, to recant comment regarding vaporization that was to appear in the publication of the American Society of Mechanical Engineers. In short, sales mentality was attempting to direct engine development!

Now for the aftermath. From the showing made by big Diesels it appears doubtful if any spark-ignited engine can outstrip in fuel economy any engine running truthfully on the excellent Diesel heat cycle. We hear it said that it takes decades at times for an inventor's idea to become commercialized. Well, what is going to happen when some young inventor tries to get funds from the banker minded to develop a high-speed engine, with greater safety for aircraft, and tells Mr. Moneybags that this engine achieves operation on the Diesel cycle? "Ha, ha, my boy! You are bright, but so are we. We're fed up on your high-speed Diesel stuff! Bye bye." This all because of dishonest naming.

Let those engineers who believe in being dominated by the banker minded go to it and bust themselves.

Robertson Matthews.

### Independent Rear Springing

There are two general solutions to the problem of independent springing of the driven (rear) wheels. The first involves the use of a system of parallel links for connection of the road wheels to the driving-gear housing; the wheels keep their upright position regardless of spring action, and the track remains practically constant. Two universal joints are required for the drive to each wheel.

With the second type, the road wheels are mounted at the outer ends of swinging half-axles, as in the conventional rear axle, but the inner ends of the half-axles are pivoted on the gear housing. The latter solution, while simpler and less expensive to produce, has the characteristic feature of changing the wheel track under spring action. In order to be able to judge the

# Calendar of Coming Events

## SHOWS

France, Automobile Section, Com'l and Industrial Fair, Lille .....March 3-18
Austria, Automobile and Motorcycle Salon, Vienna .....March 7-13
Holland, Automobile Section, Royal Netherlands Fair, Utrecht..March 9-18
Switzerland, 14th International Exposition, Automobiles, Motorcycles and Bicycles, Geneva.....March 12-21
Algiers Fair, Automobile Section, Algiers .....March 20-April 4
Portugal, 11th Automobile Salon, Porto .....March 27-April 5
Yugoslavia, 14th Automobile Salon, Zagreb .....April 17-26
Illinois Automotive Ass'n, 4th Annual Show and Maintenance Exhibit, Navy Pier, Chicago .....Apr. 24-28
Poland, Automobile Salon—16th International Fair, Poznan .....May 1-10
Norway, Automobile Salon—Oslo..May 7-10
Second Annual Automobile Maintenance Show, San Francisco..May 20-23
Morocco, Automobile Section, Tangier Fair, Tangier .....June
France, Automobile Section, Bordeaux Fair, Bordeaux .....June 13-28
Belgium, First International Aeronautical Salon, Brussels ...June 18-30
Fourth ASTM Exhibit of Testing Apparatus and Related Equipment, New York .....June 28-July 2
Poland, Automobile Salon (Foire Orientale), Lwow .....Sept. 1-15
France, 31st International Automobile Salon, Paris .....Oct. 7-17
Great Britain, 31st International Automobile Exposition, London...Oct. 14-23
National Automobile Show, New York, Oct. 27-Nov. 3
Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London..Nov. 4-13
Chicago Automobile Show .....Nov. 6-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20

## CONVENTIONS AND MEETINGS

S.A.E. National Aeronautical Meeting, Washington, D. C. .....March 11-12
Export Managers Club, 20th Anniversary Get-Together, Hotel Pennsylvania, New York .....March 30
S.A.E. Regional Transportation and Maintenance Public Utility Meeting, Baltimore, Md.....April 15-16
International Association for Testing Materials, Second International Congress, London, England..April 19-24
S.A.E. National Tractor and Industrial Power Meeting, Peoria, Ill..April 21-23
41st Annual Convention and Exposition of the American Foundrymen's Association, Milwaukee .....May 3-7
S.A.E. Summer Meeting, White Sulphur Springs, W. Va. .....May 4-9
National Battery Manufacturers Asso., Spring Convention, Shoreham Hotel, Washington, D. C....May 13-14
American Society of Mechanical Engineers, spring convention, Detroit, May 17-21
American Petroleum Institute, Mid-Year Meeting, Colorado Springs, Colo. .....June 1-3
Second World Petroleum Congress, Paris, France...late May—early June
Automotive Engine Rebuilders Association, 15th Annual Convention, Chicago .....June 21-24
American Society for Testing Materials, 40th Annual Meeting, New York, June 28-July 2
S.A.E. National Aircraft Production Meeting, Los Angeles, Calif....Oct. 7-9
S.A.E. Annual Dinner, Commodore Hotel, New York .....Oct. 28

## CONTESTS

Indianapolis Speedway, 500-Mile International Sweepstakes .....May 31
Pan American Cup Race, Roosevelt Raceway .....July 5
Roosevelt Raceway, 400-Mile George Vanderbilt Cup Sweepstakes...Sept. 6
Los Angeles, 500-Mile International Sweepstakes .....Nov. 28

relative merits of the two systems, the lateral stability of an independently sprung automobile must be considered.

Although the conventional system of four longitudinal leaf springs has a rather high center of rolling, it also possesses an inherent resistance to side sway, which is due to the torsional stiffness of the leaf springs. When independent suspension of front wheels was first introduced, a tendency of the car to roll on turns was observed. It was found possible to eliminate this by the introduction of a torsion-shaft stabilizer applied to the rear axle. When the rear wheels are also independently sprung, prevention of rolling becomes a serious problem.

Practical experience has shown that the type of rear springing using swinging half-axles is superior in respect to stability. This is due to the fact that the resistance of tires to track changes has a damping effect on the rolling motion of the car. Moreover, in case of swinging half-axles, the center of rolling is comparatively high, its location being near the inner axle pivots, or about as high as in the conventional springing system. A lower center of rolling means a greater moment of the centrifugal force on turns and a more pronounced rolling motion. With the parallel-link system of rear-wheel suspension, the center of rolling is near the ground.

When swinging half-axles were first adopted, it was anticipated that changes of wheel track would cause excessive tire wear. It was rather surprising to find that the contrary was true. The explanation is that the tires do not rub against the ground during spring action, but deform themselves sidewise, which has an effect similar to the twisting of leaf springs in the case of longitudinal spring suspension. The reduction in wear is also explained by the fact that in the case of swinging half-axles, the unsprung weight is very small.

One disadvantage of the system under discussion is uneven wear of the tire tread, due to tilting of the rear wheels. It is the usual practice in connection with swinging half-axles to give the wheels a camber of ½ to 1 deg. when the car is at rest and fully loaded. This means more camber in case of a partial load. After a period of driving with an average load, the outer sides of the rear tires show more wear. However, this is objectionable only from the appearance standpoint, since it has no effect on the durability of the tires and can be compensated for by reversing rear tires after some time, or by a special design of tire tread. By a suitable design of the tire profile the desirable damping effect of the tires could be further augmented. Longitudinal ribbing would prove most useful.

As already stated, the system of swinging half-axles has the advantage of lower manufacturing cost, owing to the smaller number of parts needed. Only one universal joint is required for each half-axle, the constant-velocity type being most suitable for the purpose. Some European light cars use ordinary universal joints in this place without any trouble. This is possible because the oscillations of half-axles amount to only a few degrees above and below the horizontal. The irregularity of rotation due to the use of normal universal joints is of a very small order and is absorbed by the backlash of driving parts, or eliminated through simultaneous motion of the other half-axle, transmitted by way of the differential gear.

In the design of Skoda, Ltd., one of the pioneers of independent rear springing, the half-axles are pin-jointed to the gear housing by means of external forks which partly encompass the gear unit. The universal joints are inside the housing in a common oil bath with the driving gears. Only two pivot bearings are needed for each half-axle with this design, as compared to eight in the system with parallel links.

It is good practice to give the half-axles some elasticity in respect to horizontal forces, such as occur when a rear wheel strikes an obstacle. This may be achieved by using rubber bushings in the pivot bearings. The springs employed for independent rear suspension are usually of the multiple-leaf type and are mounted above or below the half-axles.

In order to obtain a very compact unit, the rear pivots of the axle forks are sometimes located closer to the center line of the car than the front ones. Thus the axis of oscillation of the half-axles becomes oblique in relation to the centerline of the car. Such an arrangement has been used with complete success.

The very slight toe-in of rear wheels, which occurs under spring action, apparently has no ill effect on the stability of the car, since some of the extremely fast German race cars have swinging axles hooked up in this manner.

J. Z.

## New Mexican Automotive Company

**Organization of an enterprise to buy, sell and manufacture automobiles, trucks, tractors and motor power agricultural machinery, to be known as Auto Products, has been approved by the ministry of finance of Mexico. Officers of the company are: Harry Ewing Stewart, John W. Lutton, Carl H. Graham, George F. Kidd and Ramon Llano. The company has a capital of 25,000 pesos (about $8,000).**

Yours, Mr. Automotive Engineers, is no easy task. To build a car that will safely and surely sail the uncharted seas of tomorrow calls for no little amount of genius and courage. But through this continual gambling with the uncertainties of tomorrow, you've learned well the folly of taking anything for granted. You rightfully insist on proof that every part and parcel of your new "ship" will be capable of meeting the dangers and demands of the voyage.

On this basis we urge you to investigate, compare and test the Aetna "T" Type Clutch Release Bearing. Study its unique design that totally and permanently eliminates eccentric thrust and permits sealed, life-time lubrication, thereby ending greasy clutch facings, costly machining operations for oil fittings, noise and excessive wear. Our own exhaustive tests, plus millions of actual punishing miles, further justifies our urge for you to request complete engineering information. Write today!

**AETNA BALL BEARING MANUFACTURING COMPANY**

4608 Schubert Ave., Chicago  Detroit Office—7300 Woodward Avenue

## Delivered Prices Fixed

(*Continued from page 381*)

### OLDSMOBILE

| | At Factory Del'd | F.O.B. | Differ'l Per Cent |
|---|---|---|---|
| **Six** | | | |
| Sedan, 2-d. | $825 | $740 | +11.5 |
| Tr. sed. trk., 2-d. | 850 | 765 | +11.0 |
| Sedan, 4-d | 875 | 790 | +10.6 |
| Tr. sed. trk., 4-d. | 900 | 815 | +10.5 |
| Bus. coupe, 2-d. | 765 | 685 | +11.6 |
| Conv. coupe, 2-d. | 920 | 835 | +10.2 |
| Club coupe, 2-d. | 825 | 740 | +11.7 |
| **Eight** | | | |
| Bus. coupe, 2-d. | $880 | $785 | +12.0 |
| Club coupe, 2-d. | 940 | 840 | +12.0 |
| Sedan, 2-d. | 940 | 840 | +12.0 |
| Tour. sedan, 2-d. | 965 | 865 | +11.5 |
| Sedan, 4-d. | 990 | 890 | +11.2 |
| Tour. sedan, 4-d. | 1,015 | 915 | +11.0 |
| Conv. coupe, 2-d. | 1,035 | 935 | +10.7 |

### LA SALLE

| | At Factory Del'd | F.O.B. | Differ'l Per Cent |
|---|---|---|---|
| **Series 37-50** | | | |
| Sport coupe, 2-d., 2-p. | $1,095 | $995 | +10.0 |
| Tour. sedan, 2-d. | 1,215 | 1,105 | + 9.9 |
| Tour. sedan, 4-d., 5-p. | 1,260 | 1,145 | +10.0 |
| Conv. coupe, 2-d., 2-p. | 1,290 | 1,175 | + 9.8 |
| Conv. sedan, 4-d., 5-p. | 1,620 | 1,485 | + 9.1 |

### CORD

| | At Factory Del'd | F.O.B. | Differ'l Per Cent |
|---|---|---|---|
| Westc. sed., 4-d. | $2,445 | $1,995 | +22.6 |
| Beverly sed., 4-d. | 2,545 | 2,095 | +21.5 |
| Conv. coupe, 2-d. | 2,595 | 2,145 | +21.0 |
| Con. pha. sed., 2-d. | 2,645 | 2,195 | +20.5 |
| Schd. Westc., sed. | 2,860 | ... | ... |
| Schd. Bevly., sed. | 2,960 | ... | ... |
| Schd. conv. cpe. | 3,010 | ... | ... |
| Schd. conv. sed. | 3,060 | ... | ... |
| Cus. Berline | 3,060 | ... | ... |
| Cus. Beverly | 2,960 | ... | ... |
| S. C. Berline | 3,575 | ... | ... |
| S. C. Beverly | 3,375 | ... | ... |

### CHEVROLET

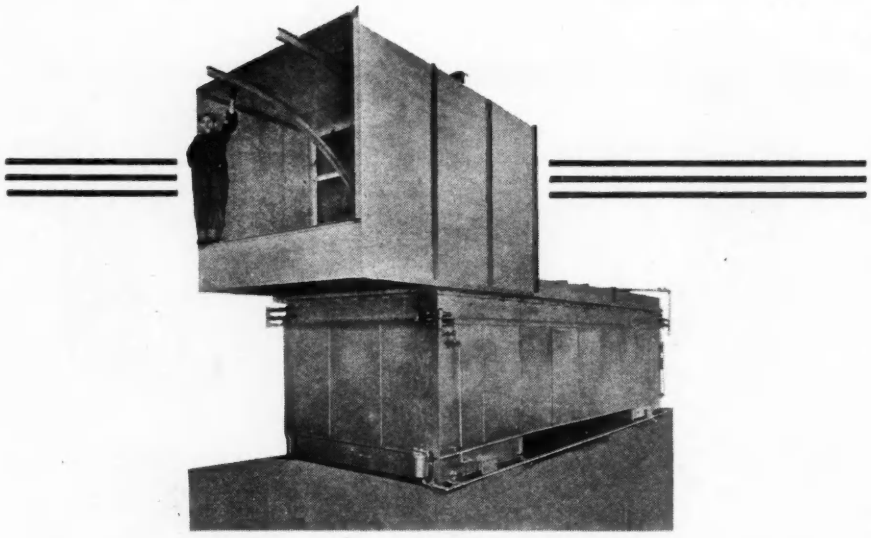
| | At Factory Del'd | F.O.B. | Differ'l Per Cent |
|---|---|---|---|
| **Master** | | | |
| Sedan, 4-d. | $667 | $595 | +12.2 |
| Coach, 2-d. | 606 | 535 | +13.2 |
| Twn. sedan, trk., 2-d. | 624 | 560 | +11.5 |
| Spt. sed. trk., 4-d. | 685 | 625 | +10.3 |
| Bus. coupe, 2-d. | 588 | 525 | +12.0 |
| Cabriolet, 2-d. | 694 | 620 | +12.0 |
| **Master De Luxe** | | | |
| Sedan, 4-d. | 739 | 660 | +12.0 |
| Coach, 2-d. | 672 | 595 | +13.0 |
| Tn. sed. trk., 2-d. | 690 | 620 | +11.2 |
| Spt. sed. trk., 4-d. | 757 | 685 | +10.6 |
| Bus. coupe, 2-d. | 655 | 585 | +11.9 |
| Sport coupe, 2-d. | 693 | 615 | +12.6 |

### HUDSON

| | Del'd |
|---|---|
| **6-73 122 in. w. b.** | |
| Bus. coupe, 2-d. | $815 |
| Coupe, 3-p., 2-d. | 860 |
| Brougham, 4-d. | 885 |
| Tour. bro., 2-d. | 910 |
| Vict. coupe, 2-d. | 905 |
| Sedan, 4-d. | 935 |
| Tour. sedan, 4-d. | 960 |
| Conv. coupe | 960 |
| Conv. bro. | 1,045 |
| **8-74 De Luxe 122-in. w. b.** | |
| Coupe, 3-p., 2-d. | 900 |
| Brougham, 2-d. | 955 |
| Vict. coupe, 2-d. | 970 |
| Tour. bro., 2-d. | 980 |
| Sedan, 4-d. | 995 |
| Tour. sedan, 4-d. | 1,020 |
| Conv. coupe | 1,035 |
| Conv. brougham | 1,120 |
| **8-75 Custom 122-in. w. b.** | |
| Coupe, 3-p., 2-d. | 1,005 |
| Brougham, 4-d. | 1,045 |
| Vict. coupe, 2-d. | 1,055 |
| Tour. bro., 2-d. | 1,070 |
| Sedan, 2-d. | 1,095 |
| Tour. sed., 2-d. | 1,120 |
| Conv. coupe | 1,130 |
| Conv. bro. | 1,215 |
| **8-76 De Luxe 129 in. w. b.** | |
| Sedan, 4-d. | 1,020 |
| Tour. sedan, 4-d. | 1,045 |
| **8-77 Custom 129 in. w. b.** | |
| Sedan, 4-d. | 1,120 |
| Tour. sedan, 4-d. | 1,145 |

### TERRAPLANE

| | Del'd |
|---|---|
| **De Luxe 6-71** | |
| Bus. coupe, 2-d. | $695 |
| Coupe, 3-p., 2-d. | 715 |
| Brougham, 2-d. | 735 |
| Tour. brog., 2-d. | 755 |
| Victoria, 2-d. | 760 |
| Sedan, 4-d. | 790 |
| Tour. sedan, 4-d. | 810 |
| Conv. coupe | 835 |
| Conv. brougham | 915 |
| **Super 6-72** | |
| Coupe, 3-p., 2-d. | 795 |
| Brougham, 2-d. | 815 |
| Tour. brougham, 2-d. | 835 |
| Victoria, 2-d. | 835 |
| Sedan, 4-d. | 865 |
| Tour. sedan, 4-d. | 885 |
| Conv. coupe | 905 |
| Conv. brougham | 985 |

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## *Claude S. Briggs*

Claude S. Briggs, pioneer automotive executive, died at his home in Detroit March 1 after a year's illness. Born in Battle Creek, he had lived in Detroit 40 years.

In 1909 Mr. Briggs founded the Krit Motor Car Co., serving as president and general manager until he sold his interest in the company a year later. He became general manager of the Brush Runabout Co. in 1911 and the following year founded the Briggs-Detroiter Co.

of which he was president until 1915. From 1918 to 1923 he served as an executive with the C. R. Wilson Body Co. He helped found the Gotfredson Corp. in 1924 and was a director and general manager until 1926 when he resigned and entered the real estate business. At the time of his death he was also an executive of the Tralette Division of the Peninsular Metal Products Co.

Mr. Briggs was a member of the SAE, the Detroit Club, the Detroit Athletic Club, and the Detroit Boat Club.

## Package Award Goes to Chevrolet for Battery

The award of first place for the most effective shipping container from the standpoint of merchandising and construction ingenuity to the Chevrolet Motor Division of General Motor Sales Corp. was announced recently by the Wolf Awards Administration.

The Chevrolet award was made in a national contest, with scores of entrants, for the packaging of the Chevrolet battery. The battery package which won first place was introduced a year ago after careful investigation by members of the Chevrolet parts and accessories department under the direction of M. D. Douglas, manager.

### *George F. Lindner*

George F. Lindner, superintendent of the Springfield works of the International Harvester Co., died this week after a brief illness. Mr. Lindner had just completed the most comprehensive modernization program in the company's history to accommodate the production of the new line of IHC light trucks.

### Jarvis Co. Buys New Plant

The Charles L. Jarvis Co., manufacturers of power appliances, has purchased a new factory in Middletown, Conn., to which it has transferred its activities from the former plant in Gildersleeve.

### Phila. Trade Association Moves

The headquarters of the Philadelphia Automobile Trade Association has been moved from the Inquirer Building to 400 North Broad Street.

### Fawick Mfg. Ghanges Name

The Fawick Manufacturing Co. of Waukesha, Wis., announces the change of its name to Industrial Clutch Co., effective at once.

## Fagg Succeeds Vidal As Air Bureau Head

Fred D. Fagg, Jr., will succeed Eugene Vidal as director of the Bureau of Air Commerce, Secretary Roper has announced. Mr. Vidal resigned, effective March 1, stating that he planned to reenter the aviation industry. Major R. W. Schroeder, chief of the airline inspection service, has been named assistant director of the bureau. Rex Martin, assistant director of the bureau in charge of navigation, has been assigned to a study mission in Latin America, and Col. J. Carroll Cone, assistant director of the bureau in charge of regulations, has been given a similar mission to Europe.

Mr. Fagg comes to the bureau from Northwestern University, Chicago, where he founded in 1929 the Air Law Institute, and has continuously served as its director in addition to editorial duties on *The Journal of Air Law*. His most recent work has been as consulting expert on the revision of air commerce regulations for the Department of Commercé.

## Convertible Coupe Added To Plymouth's 1937 Line

A convertible coupe was announced this week by the Plymouth division of the Chrysler Corp. Several of this year's innovations, such as five new kinds of insulation and windshield defroster vents, improve the closed-car comfort of Plymouth's new convertible.

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Case Study No. 108

# Precision Points the Way to Profit

**THE PROBLEM**—To produce a threaded screw for an automobile jack. Screw 4 3/4" long, 7/8" diameter with a 41/64" hole drilled 4" deep. A 15/32" hole to be drilled the balance of length of screw. Concentricity must be maintained. Part to be made of SAE X 1112 steel.

**THE SOLUTION**—Despite a thin wall (1/22") these screws are being produced on 6-spindle Model R National Acme Gridleys 33% faster than the time limit requirement. Holes are drilled with stationary oil tube drills with extreme concentricity. Scrap is only 1/5 of 1%.

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